LINKSYS®
A Division of Cisco Systems, Inc.

VONAGE
THE BROADBAND PHONE COMPANY

2.4GHz 802.11g

Wireless-G

Broadband Router with 2 Phone Ports

VoIP

Installation and Troubleshooting Guide

CISCO SYSTEMS

Model No. **WRT54GP2**

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WARNING: This product contains chemicals, including lead, known to the State of California to cause cancer, and birth defects or other reproductive harm. ***Wash hands after handling.***

How to Use this Guide

Your guide to the Wireless-G Broadband Router with 2 Phone Ports has been designed to make understanding networking with the Router easier than ever. Look for the following items when reading this guide:

This exclamation point means there is a caution or warning and is something that could damage your property or the Router.

This question mark provides you with a reminder about something you might need to do while using the Router.

This checkmark means there is a note of interest and is something you should pay special attention to while using the Router.

In addition to these symbols, there are definitions for technical terms that are presented like this:

word: *definition.*

Also, each figure (diagram, screenshot, or other image) is provided with a figure number and description, like this:

Figure 0-1: Sample Figure Description

Figure numbers and descriptions can also be found in the “List of Figures” section.

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Chapter 1: Introduction

Welcome

Thank you for choosing the Linksys Wireless-G Broadband Router with 2 Phone Ports. This Router will allow you to network wirelessly better than ever, sharing Internet access, files and fun, easily and securely. Plus, after you have set up your Vonage service, you can make phone or fax calls using your Internet connection.

How does the Router do all of this? A router is a device that allows access to an Internet connection over a network. With the Wireless-G Broadband Router with 2 Phone Ports, this access can be shared over the three switched ports or via the wireless broadcast at either up to 11Mbps for Wireless-B or up to 54Mbps for Wireless-G. In addition, the WPA standard provides greater security opportunities while the whole network is protected through NAT technology. All of these security features, as well as full configurability, are accessed through the easy-to-use browser-based utility.

But what does all of this mean?

Networks are useful tools for sharing Internet access and computer resources. Multiple computers can share Internet access, so you don't need more than one high-speed Internet connection. After you set up your Vonage account, you can also use your Internet access to make Internet phone or fax calls, even while you're surfing the Internet. Plus, you can access one printer from different computers and access data located on another computer's hard drive. Networks are even used for playing multiplayer video games. All the while, the Router protects your networks from unauthorized and unwelcome users. So, networks not only are useful in homes and offices, but also can be fun.

PCs on a wired network create a LAN, or Local Area Network. They are connected with Ethernet cables, which is why the network is called "wired".

wpa *(wi-fi protected access): a wireless security protocol using TKIP (Temporal Key Integrity Protocol) encryption, which can be used in conjunction with a RADIUS server.*

nat *(network address translation): NAT technology translated IP addresses of a local area network to a different IP address for the Internet.*

mbps*: one million bits per second; a unit of measurement for data transmission.*

browser*: an application program that provides a way to look at and interact with all the information on the World Wide Web.*

lan *(local area network): the computers and networking products that make up the network in your home or office.*

ethernet*: an IEEE standard network protocol that specifies how data is placed on and retrieved from a common transmission medium.*

PCs equipped with wireless cards or adapters can communicate without cumbersome cables. By sharing the same wireless settings, within their transmission radius, they form a wireless network, which is sometimes called a Wireless Local Area Network (WLAN). The Router bridges wireless networks of both 802.11b and 802.11g standards and wired networks, allowing them to communicate with each other.

To create your network, install and set up the Router. To guide you through the process, Linksys strongly recommends that you run the Setup Wizard on the Setup CD-ROM. If you prefer to manually set up the Router, use the instructions in the Quick Installation or this Installation and Troubleshooting Guide to help you. These instructions should be all you need to get the most out of the Wireless-G Broadband Router with 2 Phone Ports.

***802.11b**: an IEEE wireless networking standard that specifies a maximum data transfer rate of 11Mbps and an operating frequency of 2.4GHz.*

***802.11g**: an IEEE wireless networking standard that specifies a maximum data transfer rate of 54Mbps, an operating frequency of 2.4GHz, and backward compatibility with 802.11b devices.*

What's in this Guide?

This guide covers the basic steps for setting up a network with a router. After going through "Chapter 3: Getting to Know the Router," most users will only need to use the following chapters:

- Chapter 4: Connecting the Router
  This chapter instructs you on how to connect the Router to your cable or DSL modem, PCs, and telephones (or fax machines).
- Chapter 5: Configuring the Router
  This chapter explains how to configure the Router using your web browser and the Router's Web-based Utility. You will configure the Router using the settings provided by your ISP.

When you're finished with the basic steps, then you are ready to connect to the Internet.

You also have other chapters available for reference:

- Chapter 1: Introduction
  This chapter describes the Router's applications and this Installation and Troubleshooting Guide.
- Chapter 2: Planning Your Wireless Network
  This chapter describes the basics of wireless networking.
- Appendix A: Troubleshooting
  This appendix describes some possible problems and solutions, as well as frequently asked questions, regarding installation and use of the Router.
- Appendix B: Wireless Security
  This appendix explains the risks of wireless networking and some solutions to reduce the risks.
- Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter
  This appendix instructs you on how to find the MAC address or Ethernet address of your PC's Ethernet network adapter.
- Appendix D: Windows Help
  This appendix describes how you can use Windows Help for instructions about networking, such as installing the TCP/IP protocol.
- Appendix E: Glossary
  This appendix gives a brief glossary of terms frequently used in networking.
- Appendix F: Specifications
  This appendix provides the technical specifications for the Router.
- Appendix G: Warranty Information
  This appendix supplies the warranty information for the Router.

- Appendix H: Regulatory Information
  This appendix supplies the regulatory information regarding the Router.
- Appendix I: Contact Information
  This appendix provides contact information for a variety of Linksys resources, including Technical Support, as well as Vonage.

Chapter 2: Planning Your Wireless Network

Network Topology

A wireless local area network (WLAN) is exactly like a regular local area network (LAN), except that each computer in the WLAN uses a wireless device to connect to the network. Computers in a WLAN share the same frequency channel and SSID, which is an identification name shared by the wireless devices belonging to the same wireless network.

Ad-Hoc versus Infrastructure Mode

Unlike wired networks, wireless networks have two different modes in which they may be set up: infrastructure and ad-hoc. An infrastructure configuration is a WLAN and wired LAN communicating to each other through an access point. An ad-hoc configuration is wireless-equipped computers communicating directly with each other. Choosing between these two modes depends on whether or not the wireless network needs to share data or peripherals with a wired network or not.

If the computers on the wireless network need to be accessible by a wired network or need to share a peripheral, such as a printer, with the wired network computers, the wireless network should be set up in Infrastructure mode. The basis of Infrastructure mode centers around an access point or wireless router, such as the Wireless-G Broadband Router with 2 Phone Ports, which serves as the main point of communications in a wireless network. The Router transmits data to PCs equipped with wireless network adapters, which can roam within a certain radial range of the Router. You can arrange the Router and multiple access points to work in succession to extend the roaming range, and you can set up your wireless network to communicate with your Ethernet hardware as well.

***network**: a series of computers or devices connected for the purpose of data sharing, storage, and/or transmission between users.*

***ssid**: your wireless network's name.*

***ad-hoc**: a group of wireless devices communicating directly to each other (peer-to-peer) without the use of an access point.*

***infrastructure**: a wireless network that is bridged to a wired network via an access point.*

***adapter**: a device that adds network functionality to your PC.*

***ethernet**: IEEE standard network protocol that specifies how data is placed on and retrieved from a common transmission medium.*

If the wireless network is relatively small and needs to share resources only with the other computers on the wireless network, then the Ad-Hoc mode can be used. Ad-Hoc mode allows computers equipped with wireless transmitters and receivers to communicate directly with each other, eliminating the need for a wireless router or access point. The drawback of this mode is that in Ad-Hoc mode, wireless-equipped computers are not able to communicate with computers on a wired network. And, of course, communication between the wireless-equipped computers is limited by the distance and interference directly between them.

***access point**: a device that allows wireless-equipped computers and other devices to communicate with a wired network. Also used to expand the range of a wireless network.*

Network Layout

The Wireless-G Broadband Router with 2 Phone Ports has been specifically designed for use with both your 802.11b and 802.11g products. It is compatible with all 802.11b and 802.11g adapters, such as the Notebook Adapters (WPC54G, WPC11) for your laptop computers, PCI Adapter (WMP54G, WMP11) for your desktop PC, and USB Adapter (WUSB54G, WUSB11) when you want to enjoy USB connectivity. The Broadband Router will also communicate with the Wireless PrintServer (WPS54GU2, WPS11) and Wireless Ethernet Bridges (WET54G, WET11).

When you wish to connect your wireless network with your wired network, you can use the Broadband Router's three LAN ports. To add more ports, any of the Broadband Router's LAN ports can be connected to any of Linksys's switches (such as the EZXS55W or EZXS88W).

With these, and many other, Linksys products, your networking options are limitless. Go to the Linksys website at www.linksys.com for more information about products that work with the Wireless-G Broadband Router with 2 Phone Ports.

Chapter 3: Getting to Know the Router

The Back Panel

The Router's ports and the Reset button are located on the back panel of the Router.

Figure 3-1: Back Panel

Internet This **Internet** port connects to your cable or DSL modem.

Phone1 For your primary Vonage line, the **Phone1** port allows you to connect the Router to your telephone (or fax machine) using an RJ-11 telephone cable (not included).

Phone2 If you have a second Vonage line, the **Phone2** port allows you to connect the Router to your second telephone (or fax machine) using an RJ-11 telephone cable (not included).

Ethernet 1-3 These three **Ethernet** ports connect to network devices, such as PCs or more switches.

Reset Button There are two ways to reset the Router's factory defaults. Either press the **Reset Button** for five seconds, or restore the defaults from the Router's Web-based Utility.

Power The **Power** port is where you will connect the power adapter.

NOTE: The Factory Default feature of the Router's Web-based Utility is protected by a password available only from Vonage. Contact Vonage for more information.

The Front Panel

The Router's LEDs, which inform you about network activities, are located on the front panel.

Figure 3-2: Front Panel

Power Green. The **Power** LED lights up when the Router is powered on. If the LED is flashing, the Router is booting up, running a system self-test, or upgrading its firmware.

WLAN Green. The **WLAN** LED lights up when there is an active wireless connection. If the LED is flashing, the Router is sending or receiving data over the wireless network.

Ethernet 1-3 Green. The **Ethernet** LED serves two purposes. If the LED is solidly lit, the Router is connected to a device through the corresponding port (Ethernet 1, 2, or 3). If the LED is flashing, the Router is sending or receiving data over that port.

Phone 1-2 Green. The **Phone** LED is solidly lit when a telephone or fax machine has a registered connection to Vonage through the corresponding port (Phone 1 or 2). (The connection is registered if your Vonage service account is active.) Otherwise, the LED does not light up. It flashes when the phone is being used or an incoming call has been detected.

Internet Green. The **Internet** LED lights up when the Router is connected to your cable or DSL modem. If the LED is flashing, the Router is sending or receiving data over the Internet port.

Proceed to "Chapter 4: Connecting the Router."

Chapter 4: Connecting the Router

Overview

To begin installation of the Router, you will connect the Router to your PCs, telephone(s) or fax machine(s), and cable or DSL modem. The following connection diagram illustrates a basic network setup with wired connections to one desktop PC and telephone and a wireless connection to one notebook PC.

NOTE: If you already have a router in your network, then replace your existing router with the Wireless-G Broadband Router with 2 Phone Ports.

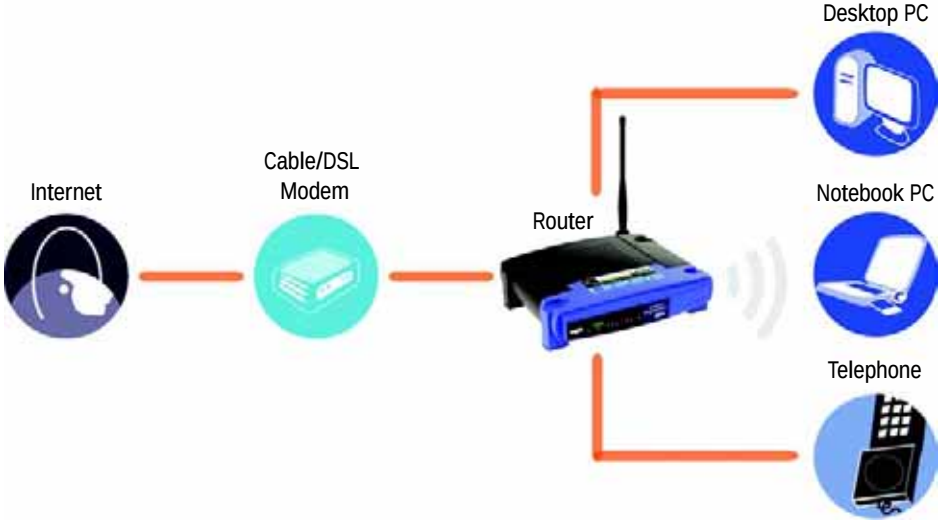

Figure 4-1: Router Connection Diagram

Connection Instructions

1. Make sure that all of your hardware is powered off, including the Router, PCs, and broadband modem.

NOTE: Make sure your telephone is set to its tone setting (not pulse).

2. Connect your broadband modem's Ethernet cable to the Router's Internet port.
3. Plug a standard telephone into the Router's Phone1 port.

IMPORTANT: Do not connect the Phone port to a telephone wall jack. Make sure you only connect a telephone or fax machine to the Phone port. Otherwise, the Router or the telephone wiring in your home or office may be damaged.

4. If you have a second Vonage phone or fax line, repeat step 3 to connect a telephone or fax machine to the Router's Phone2 port.
5. Connect one end of an Ethernet network cable to one of the numbered ports on the back of the Router. Connect the other end to an Ethernet port on a network device, e.g., a PC, print server, or switch.

   Repeat this step to connect more PCs or other network devices to the Router.

6. Power on the broadband modem.
7. Connect the included power adapter to the Router's Power port, and then plug the power adapter into an electrical outlet. The Power LED on the front panel will light up when the adapter is connected properly.
8. Power on your PC(s).

Proceed to "Chapter 5: Configuring the Router."

Figure 4-1: Connect a PC

Figure 4-2: Connect a Telephone

Figure 4-3: Connect the Modem

Figure 4-4: Connect the Power

Chapter 5: Configuring the Router

Overview

Linksys recommends using the Setup CD-ROM for first-time installation of the Router. If you do not wish to run the Setup Wizard on the Setup CD-ROM, then you can use the Web-based Utility to configure the Router. For advanced users, you may configure the Router's advanced settings through the Web-based Utility.

This chapter will describe each web page on the Utility and each page's key functions. The Utility can be accessed via your web browser through use of a computer connected to the Router. For a basic wireless network setup, most users only have to use the following screens of the Utility:

- Basic Setup. On the *Basic Setup* screen, enter the Internet connection settings provided by your ISP. If you do not have this information, you can call your ISP to request the settings. Once you have the setup information for your specific type of Internet connection, then you can configure the Router.
- Management. Click the **Administration** tab and then the **Management** tab. The Router's default password is **admin**. To secure the Router, change the Password from its default.
- Wireless. On the *Basic Wireless Settings* screen, set the basic configuration for your wireless network.

There are seven main tabs: Setup, Wireless, Security, Voice, Applications & Gaming, Administration, and Status. Additional tabs will be available after you click one of the main tabs.

Setup

- Basic Setup. Enter the Internet connection and network settings on this screen.
- DDNS. Enable the Router's Dynamic Domain Name System (DDNS) feature on this screen.
- MAC Address Clone. If you need to clone a MAC address onto the Router, use this screen.
- Advanced Routing. On this screen, you can alter Network Address Translation (NAT), Dynamic Routing, and Static Routing configurations.

Wireless

- Basic Wireless Settings. Enter the basic settings for your wireless network on this screen.
- Wireless Security. Enable and configure the security settings for your wireless network.
- Wireless Network Access. To permit or deny wireless network access for specific devices, set up MAC address filtering.
- Advanced Wireless. Advanced users can alter data tranmission settings on this screen.

Security

- Filter. To block specific users from Internet access, you can set up IP address, port, and MAC address filtering.
- VPN Passthrough. To enable or disable IPSec, PPPoE, and/or PPTP Passthrough, use this screen.

Voice

Access to the Voice tab is restricted by Vonage. Contact Vonage for more information.

Applications & Gaming

- Port Range Forwarding. Set up public services or other specialized Internet applications on your network.
- Port Triggering. To set up triggered ranges and forwarded ranges for Internet applications, click this tab.
- UPnP Forwarding. Use this screen to alter UPnP forwarding settings.
- DMZ. Click this tab to allow one local user to be exposed to the Internet for use of special-purpose services.
- QoS. Enable QoS (Quality of Service) to maximize network performance.

Administration

- Management. On this screen, alter the Router's password, access privileges, and UPnP settings. You can also back up and restore the Router's configuration if necessary.
- Log. If you want to view or save activity logs, click this tab.
- Factory Defaults. If you want to reset the Router to its factory default settings, then you will need a password available only from Vonage. Contact Vonage for more information.
- Firmware Upgrade. Upgrading the Router's firmware requires a password available only from Vonage. Contact Vonage for more information.

- Voice. This screen provides status information about your Vonage phone lines.
- Router. This screen provides status information about the Router.
- Local Network. This provides status information about the local network.

How to Access the Web-based Utility

To access the Web-based Utility of the Router, launch Internet Explorer or Netscape Navigator, and enter the Router's default IP address, **192.168.15.1**, in the *Address* field. Press the **Enter** key.

Figure 5-1: Router's IP Address

A screen will appear asking you for your User name and Password. Enter **admin** in the *User Name* and *Password* fields. Then click the **OK** button.

Make the necessary changes through the Utility. When you have finished making changes to a screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional help on a tab, click **More**.

Figure 5-2: Router Login

The Setup Tab - Basic Setup

The *Basic Setup* screen is the first screen you see when you access the Web-based Utility.

Internet Setup

The Internet Setup section configures the Router for your Internet connection type. This information can be obtained from your ISP.

Internet Connection Type

The Router supports six connection types: Obtain an IP automatically (DHCP), Static IP, PPPoE, RAS, PPTP, and Heart Beat Signal. Each *Basic Setup* screen and available features will differ depending on what kind of connection type you select.

Obtain an IP automatically

By default, the Router's Internet Connection Type is set to **Obtain an IP automatically**, and it should be used only if your ISP supports DHCP or you are connecting through a dynamic IP address.

Figure 5-3: Setup Tab - Basic Setup (Obtain an IP automatically)

Static IP

If you are required to use a permanent IP address, then select **Static IP**.

IP Address. This is the IP address that the Router has, when seen from the Internet. Your ISP will provide you with the IP Address you need to specify here.

Subnet Mask. This is the Router's Subnet Mask, as seen by external users on the Internet (including your ISP). Your ISP will provide you with the Subnet Mask.

Default Gateway. Your ISP will provide you with the Default Gateway Address.

DNS 1-3. Your ISP will provide you with at least one DNS (Domain Name System) Server IP Address.

PPPoE

Some DSL-based ISPs use PPPoE (Point-to-Point Protocol over Ethernet) to establish Internet connections for end-users. If you use a DSL line, check with your ISP to see if they use PPPoE. If they do, you will have to enable it.

User Name and Password. Enter the User Name and Password provided by your ISP.

Service Name. If provided by your ISP, enter the Service Name.

Connect on Demand and Max Idle Time. You can configure the Router to cut the Internet connection after it has been inactive for a specific period of time (Max Idle Time). If your Internet connection has been terminated due to inactivity, Connect on Demand enables the Router to automatically re-establish your connection as soon as you attempt to access the Internet again. If you wish to activate Connect on Demand, click the radio button. If you want your Internet connection to remain on at all times, enter **0** in the *Max Idle*

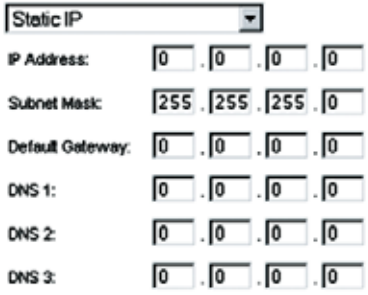

Figure 5-4: Static IP

***static ip address**: a fixed address assigned to a computer or device connected to a network.*

***subnet mask**: an address code that determines the size of the network.*

***default gateway**: a device that forwards Internet traffic from your local area network.*

***pppoe**: a type of broadband connection that provides authentication (username and password) in addition to data transport.*

Time field. Otherwise, enter the number of minutes you want to have elapsed before your Internet access disconnects.

Keep Alive and Redial Period. This option keeps your Internet access connected indefinitely, even when it sits idle. If you select this option, the Router will periodically check your Internet connection. If the connection is down, then the Router will automatically re-establish the connection. To use this option, click the radio button next to *Keep Alive*. The default Redial Period is 30 seconds.

When you are finished, click the **Save Settings** button. Then click the **Status** tab, and click the **Connect** button to start the connection.

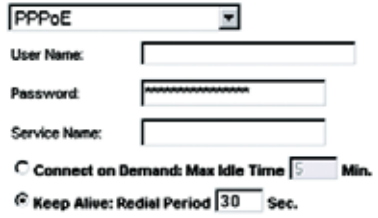

Figure 5-5: PPPoE

NOTE: For DSL users, if you need to enable PPPoE support, remember to remove any PPPoE applications that are installed on your PCs.

RAS (for SingTel)

Remote Access Service (RAS) is a service that applies to connections in Singapore only. For users in Singapore, check with Singtel for information on RAS.

User Name and Password. Enter the User Name and Password supplied by Singtel.

RAS Plan. Select the type of plan you have.

Connect on Demand and Max Idle Time. You can configure the Router to cut the Internet connection after it has been inactive for a specific period of time (Max Idle Time). If your Internet connection has been terminated due to inactivity, Connect on Demand enables the Router to automatically re-establish your connection as soon as you attempt to access the Internet again. If you wish to activate Connect on Demand, click the radio button. If you want your Internet connection to remain on at all times, enter **0** in the *Max Idle Time* field. Otherwise, enter the number of minutes you want to have elapsed before your Internet access disconnects.

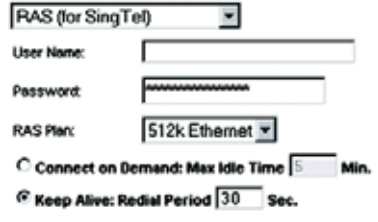

Figure 5-6: RAS (for Singtel)

Keep Alive and Redial Period. This option keeps your Internet access connected indefinitely, even when it sits idle. If you select this option, the Router will periodically check your Internet connection. If the connection is down, then the Router will automatically re-establish the connection. To use this option, click the radio button next to *Keep Alive*. The default Redial Period is 30 seconds.

When you are finished, click the **Save Settings** button. Then click the **Status** tab, and click the **Connect** button to start the connection.

PPTP

Point-to-Point Tunneling Protocol (PPTP) is a service that applies to connections in Europe and Israel only.

IP Address. This is the IP address that the Router has, when seen from the Internet. Your ISP will provide you with the IP Address you need to specify here.

Subnet Mask. This is the Router's Subnet Mask, as seen by external users on the Internet (including your ISP). Your ISP will provide you with the Subnet Mask.

Default Gateway. Your ISP will provide you with the Default Gateway Address.

User Name and Password. Enter the User Name and Password provided by your ISP.

Connect on Demand and Max Idle Time. You can configure the Router to cut the Internet connection after it has been inactive for a specific period of time (Max Idle Time). If your Internet connection has been terminated due to inactivity, Connect on Demand enables the Router to automatically re-establish your connection as soon as you attempt to access the Internet again. If you wish to activate Connect on Demand, click the radio button. If you want your Internet connection to remain on at all times, enter **0** in the *Max Idle Time* field. Otherwise, enter the number of minutes you want to have elapsed before your Internet access disconnects.

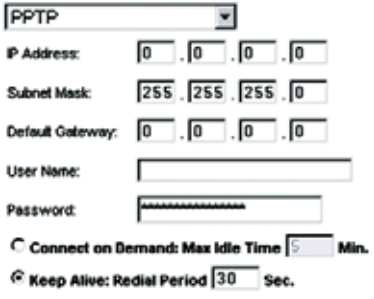
PPTP
IP Address:
0 . 0 . 0 . 0
Subnet Mask:
255 . 255 . 255 . 0
Default Gateway:
0 . 0 . 0 . 0
User Name:
Password:
Connect on Demand: Max Idle Time 5 Min.
Keep Alive: Redial Period 30 Sec.

Figure 5-7: PPTP

Keep Alive and Redial Period. This option keeps your Internet access connected indefinitely, even when it sits idle. If you select this option, the Router will periodically check your Internet connection. If the connection is down, then the Router will automatically re-establish the connection. To use this option, click the radio button next to *Keep Alive*. The default Redial Period is 30 seconds.

When you are finished, click the **Save Settings** button. Then click the **Status** tab, and click the **Connect** button to start the connection.

Heart Beat Signal

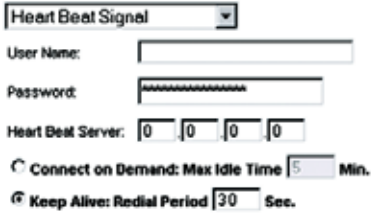

Figure 5-8: Heart Beat Signal

Heart Beat Signal is a service used in Australia only. If you are using a Heart Beat Signal connection, check with your ISP for the necessary setup information.

User Name and Password. Enter the User Name and Password provided by your ISP.

Heart Beat Server. This is the IP address that the Router has, when seen from the Internet. Your ISP will provide you with the IP Address you need to specify here.

Connect on Demand and Max Idle Time. You can configure the Router to cut the Internet connection after it has been inactive for a specific period of time (Max Idle Time). If your Internet connection has been terminated due to inactivity, Connect on Demand enables the Router to automatically re-establish your connection as soon as you attempt to access the Internet again. If you wish to activate Connect on Demand, click the radio button. If you want your Internet connection to remain on at all times, enter **0** in the *Max Idle Time* field. Otherwise, enter the number of minutes you want to have elapsed before your Internet access disconnects.

Keep Alive and Redial Period. This option keeps your Internet access connected indefinitely, even when it sits idle. If you select this option, the Router will periodically check your Internet connection. If the

connection is down, then the Router will automatically re-establish the connection. To use this option, click the radio button next to *Keep Alive*. The default Redial Period is 30 seconds.

When you are finished, click the **Save Settings** button. Then click the **Status** tab, and click the **Connect** button to start the connection.

Optional Settings

Some of these settings may be required by your ISP. Verify with your ISP before making any changes.

Host Name and Domain Name. These fields allow you to supply a host and domain name for the Router. Some ISPs require these names as identification. You may have to check with your ISP to see if your broadband Internet service has been configured with a host and domain name. In most cases, leaving these fields blank will work.

MTU. The MTU (Maximum Transmission Unit) setting specifies the largest packet size permitted for network transmission. Select **Enable** and enter the value desired. It is recommended that you leave this value in the 1200 to 1500 range. For most DSL users, it is recommended to use the value 1492. By default, MTU is set at 1500 when disabled.

***packet**: a unit of data sent over a network.*

Network Setup

The Network Setup section allows you to change the Router's local network settings.

Router IP

The values for the Router's Local IP Address and Subnet Mask are shown here. In most cases, keeping the default values will work.

Local IP Address. The default value is **192.168.15.1**.

Subnet Mask. The default value is **255.255.255.0**.

Network Address Server Settings (DHCP)

These settings allow you to configure the Router's Dynamic Host Configuration Protocol (DHCP) server function. The Router can be used as a DHCP server for your network. A DHCP server automatically assigns an IP address to each computer on your network. Unless you already have one, it is highly recommended that you leave the Router enabled as a DHCP server.

Local DHCP Server. DHCP is enabled by factory default. If you already have a DHCP server on your network, set the Router's DHCP option to **Disable**. If you disable DHCP, remember to assign a static IP address to the Router.

Start IP Address. Enter a value for the DHCP server to start with when issuing IP addresses. Because the default IP address for the Router is 192.168.15.1, the Start IP Address must be 192.168.15. 2 or greater, but smaller than 192.168.15.254. The default Start IP Address is **192.168.15.100**.

Number of Address (Optional). Enter the maximum number of PCs that you want the DHCP server to assign IP addresses to. This number cannot be greater than 253. The default is **50**.

DHCP Address Range. The range of DHCP addresses is displayed here.

Client Lease Time. The Client Lease Time is the amount of time a network user will be allowed connection to the Router with their current dynamic IP address. Enter the amount of time, in minutes, that the user will be "leased" this dynamic IP address. After the dynamic IP address has expired, the user will be automatically assigned a new dynamic IP address. The default is **0** minutes, which means one day.

***dynamic ip address**: a temporary IP address assigned by a DHCP server.*

DNS 1-3. The Domain Name System (DNS) is how the Internet translates domain or website names into Internet addresses or URLs. Your ISP will provide you with at least one DNS Server IP Address. You can enter up to three DNS Server IP Addresses here. The Router will use these for quicker access to functioning DNS servers.

WINS. The Windows Internet Naming Service (WINS) converts NetBIOS names to IP addresses. If you use a WINS server, enter that server's IP address here. Otherwise, leave this field blank.

Time Setting

Change the time zone in which your network functions from this pull-down menu.

When you have finished making changes to this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

NOTE: To test your settings, connect to the Internet now.

The Setup Tab - DDNS

The Router offers a Dynamic Domain Name System (DDNS) feature. DDNS lets you assign a fixed host and domain name to a dynamic Internet IP address. It is useful when you are hosting your own website, FTP server, or other server behind the Router.

Before you can use this feature, you need to sign up for DDNS service at one of two DDNS service providers, DynDNS.org or TZO.com. If you do not want to use this feature, keep the default setting, **Disable**.

***ddns**: allows the hosting of a website, FTP server, or e-mail server with a fixed domain name (e.g., www.xyz.com) and a dynamic IP address.*

DDNS

DDNS Service. If your DDNS service is provided by DynDNS.org, then select **DynDNS.org** from the drop-down menu. If your DDNS service is provided by TZO, then select **TZO.com**. The features available on the *DDNS* screen will vary, depending on which DDNS service provider you use.

Figure 5-9: Setup Tab - DDNS (DynDNS.org)

DynDNS.org

User Name, Password, and Host Name. Enter the User Name, Password, and Host Name of the account you set up with DynDNS.org.

Internet IP Address. The Router's current Internet IP Address is displayed here. Because it is dynamic, it will change.

Status. The status of the DDNS service connection is displayed here.

Figure 5-10: Setup Tab - DDNS (TZO.com)

TZO.com

E-mail Address, Password, and Domain Name. Enter the Email Address, Password, and Domain Name of the service you set up with TZO.

Internet IP Address. The Router's current Internet IP Address is displayed here. Because it is dynamic, this will change.

Status. The status of the DDNS service connection is displayed here.

When you have finished making changes to this screen, click the **Update** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

The Setup Tab - MAC Address Clone

A MAC address is a 12-digit code assigned to a unique piece of hardware for identification, like a social security number. Some ISPs will require you to register a MAC address in order to access the Internet. If you do not wish to re-register the MAC address with your ISP, you may assign the MAC address you have currently registered with your ISP to the Router with the MAC Address Clone feature.

MAC Clone

MAC Clone Service. To use MAC address cloning, select **Enable**.

MAC Address. Enter the MAC Address registered with your ISP. Then click the **Save Settings** button.

Clone. If you want to clone the MAC address of the PC you are currently using to configure the Router, then click the **Clone** button. The Router will automatically detect your PC's MAC address, so you do NOT have to call your ISP to change the registered MAC address to the Router's MAC address. It is recommended that the PC registered with the ISP is used to open the *MAC Address Clone* screen.

When you have finished making changes to this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

Figure 5-11: Setup Tab - MAC Address Clone

***mac address**: the unique address that a manufacturer assigns to each networking device.*

The Setup Tab - Advanced Routing

The *Advanced Routing* screen allows you to configure the Network Address Translation (NAT), dynamic routing, and static routing settings.

Figure 5-12: Setup Tab - Advanced Routing

Advanced Routing

NAT. NAT is a security feature that is enabled by default. It enables the Router to translate IP addresses of your local area network to a different IP address for the Internet. To disable NAT, click the **Disable** radio button. (When NAT is disabled, the DHCP server feature is also disabled.)

Dynamic Routing. This feature enables the Router to automatically adjust to physical changes in the network's layout and exchange routing tables with the other router(s). The Router determines the network packets' route based on the fewest number of hops between the source and the destination. Dynamic Routing is enabled by default. To disable this feature, click the **Disable** radio button.

Transmit RIP Version. To use dynamic routing for transmission of network data, select the protocol you want: **RIP1**, **RIP1-Compatible**, or **RIP2**.

Receive RIP Version. To use dynamic routing for reception of network data, select the protocol you want, **RIP1** or **RIP2**.

Static Routing. Use this feature to set up a static router between the Router and another network. (A static route is a pre-determined pathway that network information must travel to reach a specific host or network.) To create a static route, alter the following settings:

Select Entry. Select the number of the static route from the drop-down menu. The Router supports up to 20 static route entries.

Enter Route Name. Enter a name for the static route, using a maximum of 25 alphanumeric characters.

Destination LAN IP. The Destination LAN IP Address is the address of the remote network or host to which you want to assign a static route. Enter the IP address of the host for which you wish to create a static route.

Subnet Mask. The Subnet Mask determines which portion of a Destination IP address is the network portion, and which portion is the host portion.

Gateway. This is the IP address of the gateway device that allows for contact between the Router and the remote network or host.

Hop Count. This determines the maximum number of steps between network nodes that data packets will travel. A node is any device on the network, such as PCs, print servers, routers, etc.

Interface. Select **Local** or **Internet**, depending on the location of the static route's final destination.

Delete Entry. If you need to delete a route, select its number from the drop-down menu, and click the **Delete Entry** button.

Show Routing Table. Click the **Show Routing Table** button to open a screen displaying how data is routed through your local network. For each route, the Destination LAN IP address, Subnet Mask, Default Gateway, Hop Count, and Interface are displayed. Click the **Refresh** button to update the information.

Figure 5-13: Routing Table Entry List

When you have finished making changes to this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

The Wireless Tab - Basic Wireless Settings

Figure 5-14: Wireless Tab - Basic Wireless Settings

The basic settings for wireless networking are set on this screen.

Wireless Network Mode. From this drop-down menu, you can select the wireless standards running on your network. If you have both 802.11g and 802.11b devices in your network, keep the default setting, **Mixed**. If you have only 802.11g devices, select **G-Only**. If you have only 802.11b devices, select **B-Only**. If you do not have any 802.11g and 802.11b devices in your network, select **Disable**.

Wireless Network Name (SSID). The SSID is the network name shared among all points in a wireless network. The SSID must be identical for all devices in the wireless network. It is case-sensitive and must not exceed 32 characters (use any of the characters on the keyboard). Make sure this setting is the same for all points in your wireless network. For added security, you should change the default SSID (**linksys**) to a unique name.

Wireless Channel. Select the appropriate channel from the list provided to correspond with your network settings. All devices in your wireless network must be broadcast on the same channel in order to function correctly.

Wireless SSID Broadcast. When wireless clients survey the local area for wireless networks to associate with, they will detect the SSID broadcast by the Router. To broadcast the Router's SSID, keep the default setting, **Enable**. If you do not want to broadcast the Router's SSID, then select **Disable**.

When you have finished making changes on this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

The Wireless Tab - Wireless Security

The Wireless Security settings configure the security of your wireless network. There are three wireless security mode options supported by the Router: WPA Pre-Shared Key, WPA RADIUS, and WEP. (WPA stands for Wi-Fi Protected Access, which is a security standard stronger than WEP encryption. WEP stands for Wired Equivalent Privacy, while RADIUS stands for Remote Authentication Dial-In User Service.) These three are briefly discussed here. For detailed instructions on configuring wireless security for the Router, proceed to "Appendix B: Wireless Security."

wpa *(wi-fi protected access): a wireless security protocol using TKIP (Temporal Key Integrity Protocol) encryption, which can be used in conjunction with a RADIUS server.*

wep *(wired equivalent privacy): a method of encrypting network data transmitted on a wireless network for greater security.*

WPA Pre-Shared Key. WPA gives you one encryption method, TKIP, with dynamic encryption keys. Select **TKIP** from the *WPA Algorithm* drop-down menu. Enter a WPA Shared Key of 8-32 characters. Then enter the Group Key Renewal period, which instructs the Router how often it should change the encryption keys.

When you have finished making changes on this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

Figure 5-15: Wireless Tab - Wireless Security (WPA Pre-Shared Key)

WPA RADIUS. This option features WPA used in coordination with a RADIUS server. (This should only be used when a RADIUS server is connected to the Router.) First Select **TKIP** from the *WPA Algorithm* drop-down menu. Enter the RADIUS server's IP address and port number, along with the WPA Shared Key, which is the key shared between the Router and the server. Last, enter the Group Key Renewal period, which instructs the Router how often it should change the encryption keys.

When you have finished making changes on this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

Figure 5-16: Wireless Tab - Wireless Security (WPA RADIUS)

***radius**: a protocol that uses an authentication server to control network access.*

WEP. WEP is a basic encryption method, which is not as secure as WPA. To use WEP, select a level of WEP encryption, **64 bits 10 hex digits** or **128 bits 26 hex digits**. If you want to use a Passphrase, then enter it in the *Passphrase for keys* field and click the **Generate** button. If you want to enter the WEP key manually, then enter it in the *WEP Key* field(s). To indicate which WEP key to use, select the appropriate *Default Key* number.

When you have finished making changes on this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

Figure 5-17: Wireless Tab - Wireless Security (WEP)

The Wireless Tab - Wireless Network Access

Wireless access can be filtered by using the MAC addresses of the wireless devices transmitting within your network's radius.

MAC Filter. To filter wireless access by MAC Address, click **Enable**. If you do not wish to filter access by MAC Address, select **Disable**.

Deny. Clicking this button will block wireless access by MAC Address.

Allow. Clicking this button will permit wireless access by MAC Address.

Select MAC Address from Networked Computers. Clicking this button will open the Wireless Client MAC List. On this screen, you can view users, by MAC Address, to whom you wish to provide or block access. To enable MAC filtering for a specific computer, click the *Enable MAC Filter* checkbox. When you have finished your changes, click the **Save** button. Click the **Cancel** button to cancel your changes. To update the information on the Wireless Client MAC List, click the **Refresh** button.

When you have finished making changes on this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

Figure 5-18: Wireless Tab - Wireless Network Access

Figure 5-19: Wireless Client MAC List

The Wireless Tab - Advanced Wireless Settings

Figure 5-20: Advanced Wireless Settings

This tab is used to set up the Router's advanced wireless functions. These settings should only be adjusted by an expert administrator as incorrect settings can reduce wireless performance.

Basic Rate. The Basic Rate setting is not actually one rate of transmission but a series of rates at which the Router can transmit. The Router will advertise its Basic Rate to the other wireless devices in your network, so they know which rates will be used. The Router will also advertise that it will automatically select the best rate for transmission. The default setting is **Default**, when the Router can transmit at all standard wireless rates (1-2Mbps, 5.5Mbps, 11Mbps, 18Mbps, and 24Mbps). Other options are **1-2Mbps**, for use with older wireless technology, and **All**, when the Router can transmit at all wireless rates. The Basic Rate is not the actual rate of data transmission. If you want to specify the Router's rate of data transmission, configure the Transmission Rate setting.

Control Tx Rate. The rate of data transmission should be set depending on the speed of your wireless network. You can select from a range of transmission speeds, or you can select **Auto** to have the Router automatically use the fastest possible data rate and enable the Auto-Fallback feature. Auto-Fallback will negotiate the best possible connection speed between the Router and a wireless client. The default value is **Auto**.

Preamble Type. The preamble defines the length of the CRC block for communication between the Router and the roaming Network Card. (High network traffic areas should use the shorter preamble type.) Select the appropriate preamble type, **Long Preamble (default)** or **Short Preamble**.

Authentication Type. The default is set to **Auto**, which allows either Open System or Shared Key authentication to be used. With **Open System** authentication, the sender and the recipient do NOT use a WEP key for authentication. With **Shared Key** authentication, the sender and recipient use a WEP key for authentication.

CTS Protection Mode. CTS (Clear-To-Send) Protection Mode should remain disabled unless you are having severe problems with your Wireless-G products. If these products are not able to transmit to the Router in an

cts *(clear to send): a signal sent by a wireless device, signifying that it is ready to receive data.*

environment with heavy 802.11b traffic, then enable CTS Protection Mode. This function boosts the Router's ability to catch all Wireless-G transmissions but will significantly decrease performance.

Beacon Interval. The default value is **100**. Enter a value between 1 and 65,535 milliseconds. The Beacon Interval value indicates the frequency interval of the beacon. A beacon is a packet broadcast by the Router to synchronize the wireless network.

***beacon interval**: data transmitted on your wireless network that keeps the network synchronized.*

DTIM Interval. This value, between 1 and 255, indicates the interval of the Delivery Traffic Indication Message (DTIM). A DTIM field is a countdown field informing clients of the next window for listening to broadcast and multicast messages. When the Router has buffered broadcast or multicast messages for associated clients, it sends the next DTIM with a DTIM Interval value. Its clients hear the beacons and awaken to receive the broadcast and multicast messages. The default value is **1**.

***dtim**: a message included in data packets that can increase wireless efficiency.*

Fragmentation Threshold. This value specifies the maximum size for a packet before data is fragmented into multiple packets. If you experience a high packet error rate, you may slightly increase the Fragmentation Threshold. Setting the Fragmentation Threshold too low may result in poor network performance. Only minor reduction of the default value is recommended. In most cases, it should remain at its default value of **2346**.

***fragmentation**: breaking a packet into smaller units when transmitting over a network medium that cannot support the original size of the packet.*

RTS Threshold. Should you encounter inconsistent data flow, only minor reduction of the default value, **2347**, is recommended. If a network packet is smaller than the preset RTS threshold size, the RTS/CTS mechanism will not be enabled. The Router sends Request to Send (RTS) frames to a particular receiving station and negotiates the sending of a data frame. After receiving an RTS, the wireless station responds with a Clear to Send (CTS) frame to acknowledge the right to begin transmission. The RTS Threshold value should remain at its default value of **2347**.

When you have finished making changes on this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

The Security Tab - Filter

When you click the Security tab, you will see the *Filter* screen. Filters block specific internal users from accessing the Internet and block anonymous Internet requests and/or multicasting.

Figure 5-21: Security Tab - Filter

Filter IP Address Range

You can create up to five different IP Address Range filters. To set up a filter using IP addresses, enter the range of IP addresses you wish to filter in the *Start* and *End* fields. Users who have filtered IP addresses will not be able to access the Internet at all. If you only want to filter one IP address instead of a range of IP addresses, enter the same value into both fields. For instance, if you wish to filter the PC with the IP address of 192.168.15.5, enter **5** into both fields on one line: 192.168.15.**5** ~ 192.168.15.**5**.

Filter Port Range

You can create up to five different Port Range filters. To filter users by network port number, select the protocol you want to filter, **TCP**, **UDP**, or **Both**, from the *Protocol* drop-down menu. Enter the port numbers you want to filter in the *Start* and *End* fields. Users connected to the Router will no longer be able to access any port number listed there.

Filter MAC Address

This feature blocks computers with specific MAC addresses from going out to the Internet. For information on obtaining a MAC address, go to "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter." To set the MAC filter, click the **Edit MAC Filter Setting** button.

Edit MAC Filter Setting. Click the **Edit MAC Filter Setting** button. Select the range of MAC address entries in the drop-down box. In each *mac* field, enter the MAC address you want to filter. Click the **Apply** button before closing the window. To cancel changes, click the **Undo** button.

Figure 5-22: Filtered MAC Address

Block WAN Requests

Use these features to enhance your network's security and filter multicasting.

Block Anonymous Internet Requests. This keeps your network from being "pinged" or detected and reinforces your network security by hiding your network ports, so it is more difficult for intruders to work their way into your network. Select **Enabled** to block anonymous Internet requests, or **Disabled** to allow anonymous Internet requests.

Filter Multicast. Multicasting allows for multiple transmissions to specific recipients at the same time. If multicasting is permitted, then the Router will allow IP multicast packets to be forwarded to the appropriate computers. Select **Enabled** to filter multicasting, or **Disabled** to disable this feature.

Filter Internet NAT Redirection. This feature uses port forwarding to block access to local servers from local networked computers. Select **Enabled** to filter Internet NAT redirection, or **Disabled** to disable this feature.

Filter IDENT (Port 113). This feature keeps port 113 from being scanned by devices outside of your local network. Select **Enabled** to filter port 113, or **Disabled** to disable this feature.

When you have finished making changes to this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

The Security Tab - VPN Passthrough

The *VPN Passthrough* screen allows you to allow VPN tunnels using IPSec, PPPoE, or PPTP protocols to pass through the Router.

VPN Passthrough

IPSec Passthrough. IPSec (Internet Protocol Security) is a suite of protocols used to implement secure exchange of packets at the IP layer. To allow IPSec Passthrough, click the **Enabled** button. To disable IPSec Passthrough, click the **Disabled** button.

PPPoE Passthrough. PPPoE (Point-to-Point over Ethernet) Passthrough allows your PC(s) to use the PPPoE client software provided by your ISP. Some ISPs may request that you use this feature on the Router. To allow PPPoE Passthrough, click the **Enabled** button. To disable PPPoE Passthrough, click the **Disabled** button.

PPTP Pass Through. PPTP (Point-to-Point Tunneling Protocol) Passthrough allows the Point-to-Point (PPP) to be tunneled through an IP network. To allow PPTP Passthrough, click the **Enabled** button. To disable PPTP Passthrough, click the **Disabled** button.

When you have finished making changes to this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

Figure 5-23: Security Tab - VPN Passthrough

***vpn**: a security measure to protect data as it leaves one network and goes to another over the Internet.*

***ipsec**: a VPN protocol used to implement secure exchange of packets at the IP layer.*

***pppoe**: a type of broadband connection that provides authentication (username and password) in addition to data transport.*

***pptp**: a VPN protocol that allows the Point to Point Protocol (PPP) to be tunneled through an IP network. This protocol is also used as a type of broadband connection in Europe.*

The Voice Tab

Access to the Voice tab is restricted by Vonage. Contact Vonage for more information.

Figure 5-24: Voice Tab

The Applications & Gaming Tab - Port Range Forwarding

When you click the Applications & Gaming tab, you will see the *Port Range Forwarding* screen. Port Range Forwarding sets up public services on your network, such as web servers, ftp servers, e-mail servers, or other specialized Internet applications. (Specialized Internet applications are any applications that use Internet access to perform functions such as videoconferencing or online gaming. Some Internet applications may not require any forwarding.) When users send this type of request to your network via the Internet, the Router will forward those requests to the appropriate PC.

Before using forwarding, you should assign a static IP address to the designated PC.

If you need to forward all ports to one PC, click the **DMZ** tab.

Figure 5-25: Applications & Gaming Tab - Port Range Forwarding

Port Range Forwarding

Port Range

To add a server using Port Range Forwarding, complete the following fields:

Application. Enter the name of the application.

Start and End. Enter the number or range of external port(s) used by the server or Internet application. Check with the Internet application software documentation for more information.

Protocol. Select the protocol **TCP** or **UDP**, or select **Both**.

IP Address. Enter the IP address of the server that you want the Internet users to be able to access. To find the IP address, go to "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter."

Enable. Check the **Enable** box to enable the services you have defined. Port Range Forwarding will not function if the Enabled button is left unchecked. This is disabled (unchecked) by default.

When you have finished making changes to this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

The Applications & Gaming Tab - Port Triggering

The *Port Triggering* screen allows the Router to watch outgoing data for specific port numbers. The IP address of the computer that sends the matching data is remembered by the Router, so that when the requested data returns through the Router, the data is pulled back to the proper computer by way of IP address and port mapping rules.

Port Triggering

Application. Enter the application name of the trigger.

Triggered Range

For each application, list the triggered port number range. Check with the Internet application documentation for the port number(s) needed.

Start Port. Enter the starting port number of the Triggered Range.

tcp*: a network protocol for transmitting data that requires acknowledgement from the recipient of data sent.*

udp*: a network protocol for transmitting data that does not require acknowledgement from the recipient of the data that is sent.*

ip *(internet protocol): a protocol used to send data over a network.*

ip address*: the address used to identify a computer or device on a network.*

Figure 5-26: Applications & Gaming Tab - Port Triggering

End Port. Enter the ending port number of the Triggered Range.

Forwarded Range

For each application, list the forwarded port number range. Check with the Internet application documentation for the port number(s) needed.

Start Port. Enter the starting port number of the Forwarded Range.

End Port. Enter the ending port number of the Forwarded Range.

When you have finished making changes to this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

The Applications & Gaming Tab - UPnP Forwarding

The *UPnP Forwarding* screen displays preset application settings as well as options to customize port services for other applications.

UPnP Forwarding

Application. Ten applications are preset. For custom applications, enter the name of your application in one of the available fields.

The preset applications are among the most widely used Internet applications. They include the following:

Figure 5-27: Applications & Gaming Tab - UPnP Forwarding

FTP (File Transfer Protocol). A protocol used to transfer files over a TCP/IP network (Internet, UNIX, etc.). For example, after developing the HTML pages for a website on a local machine, they are typically uploaded to the web server using FTP.

Telnet. A terminal emulation protocol commonly used on Internet and TCP/IP-based networks. It allows a user at a terminal or computer to log onto a remote device and run a program.

SMTP (Simple Mail Transfer Protocol). The standard e-mail protocol on the Internet. It is a TCP/IP protocol that defines the message format and the message transfer agent (MTA), which stores and forwards the mail.

DNS (Domain Name System). The way that Internet domain names are located and translated into IP addresses. A domain name is a meaningful and easy-to-remember "handle" for an Internet address.

TFTP (Trivial File Transfer Protocol). A version of the TCP/IP FTP protocol that has no directory or password capability.

Finger. A UNIX command widely used on the Internet to find out information about a particular user, such as a telephone number, whether the user is currently logged on, and the last time the user was logged on. The person being "fingered" must have placed his or her profile on the system in order for the information to be available. Fingering requires entering the full user@domain address.

HTTP (HyperText Transport Protocol). The communications protocol used to connect to servers on the World Wide Web. Its primary function is to establish a connection with a web server and transmit HTML pages to the client web browser.

POP3 (Post Office Protocol 3). A standard mail server commonly used on the Internet. It provides a message store that holds incoming e-mail until users log on and download it. POP3 is a simple system with little selectivity. All pending messages and attachments are downloaded at the same time. POP3 uses the SMTP messaging protocol.

NNTP (Network News Transfer Protocol). The protocol used to connect to Usenet groups on the Internet. Usenet newsreaders support the NNTP protocol.

SNMP (Simple Network Management Protocol). A widely used network monitoring and control protocol. Data is passed from SNMP agents, which are hardware and/or software processes reporting activity in each network device (hub, router, bridge, etc.) to the workstation console used to oversee the network. The agents return information contained in a MIB (Management Information Base), which is a data structure that defines what is obtainable from the device and what can be controlled (turned off, on, etc.).

Ext. Port. Enter the number of the external port used by the server in the *Ext. Port* column. Check with the Internet application documentation for more information.

TCP or UDP. Select the protocol **UDP** or **TCP** for each application. You cannot select both protocols.

Int. Port. Enter the number of the internal port used by the server in the *Int. Port* column. Check with the Internet application software documentation for more information.

IP Address. Enter the IP address of the server that you want the Internet users to be able to access. To find the IP address, go to "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter."

Enabled. Check the **Enabled** box to enable the service you have defined. UPnP Forwarding will not function if the Enabled button is left unchecked. This is disabled (unchecked) by default.

When you have finished making changes to this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

The Applications & Gaming Tab - DMZ

The *DMZ* screen allows one local user to be exposed to the Internet for use of a special-purpose service such as Internet gaming and videoconferencing. DMZ hosting forwards all the ports at the same time to one PC. The Port Range Forwarding is more secure because it only opens the ports you want to have opened, while DMZ hosting opens all the ports of one computer, exposing the computer to the Internet.

Any PC whose port is being forwarded must have its DHCP client function disabled and should have a new static IP address assigned to it because its IP address may change when using the DHCP function.

Figure 5-28: Applications & Gaming Tab - DMZ

DMZ

DMZ. To use this feature, select **Enable**. To disable DMZ hosting, select **Disable**.

DMZ Host IP Address. To expose one PC, enter the computer's IP address. To get the IP address of a computer, refer to "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter." Deactivate DMZ by entering a **0** in the field.

When you have finished making changes to this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

The Applications & Gaming Tab - QoS

Quality of Service (QoS) ensures better service to high-priority types of network traffic, which may involve demanding, real-time applications, such as Internet phone calls or videoconferencing.

Application-based QoS

Application-based QoS manages information as it is transmitted and received. Depending on the settings of the *QoS* screen, this feature will assign information a high or low priority for the five preset applications and three additional applications that you specify.

Enable/Disable. To use application-based QoS, select **Enable**. Otherwise, keep the default, **Disable**.

High priority/Low priority. For each application, select **High priority** or **Low priority**.

FTP (File Transfer Protocol). A protocol used to transfer files over a TCP/IP network (Internet, UNIX, etc.). For example, after developing the HTML pages for a website on a local machine, they are typically uploaded to the web server using FTP.

HTTP (HyperText Transport Protocol). The communications protocol used to connect to servers on the World Wide Web. Its primary function is to establish a connection with a web server and transmit HTML pages to the client web browser.

Telnet. A terminal emulation protocol commonly used on Internet and TCP/IP-based networks. It allows a user at a terminal or computer to log onto a remote device and run a program.

SMTP (Simple Mail Transfer Protocol). The standard e-mail protocol on the Internet. It is a TCP/IP protocol that defines the message format and the message transfer agent (MTA), which stores and forwards the mail.

Figure 5-29: Applications & Gaming Tab - QoS

POP3 (Post Office Protocol 3). A standard mail server commonly used on the Internet. It provides a message store that holds incoming e-mail until users log on and download it. POP3 is a simple system with little selectivity. All pending messages and attachments are downloaded at the same time. POP3 uses the SMTP messaging protocol.

Specific Port#. You can add three additional applications by entering their respective port numbers in the *Specific Port#* fields.

Port-based QoS

Port-based QoS allows you to prioritize performance for three of the Router's ports, LAN Ports 1-3. Port-based QoS does not require support from your ISP because the prioritized ports are LAN ports going out to your network.

Enable/Disable. To use port-based QoS, select **Enable**. Otherwise, keep the default, **Disable**.

For each port, specify the Priority, Flow Control setting, and Ingress Rate Limit.

Priority. Select the port's priority level, **High** or **Low**.

Flow Control. If you want the Router to control the transmission of data between network devices, select **Enable**. To disable this feature, select **Disable**.

Ingress Rate Limit. This setting limits the incoming bandwidth. To use this feature, select **8M**, **4M**, **2M**, **1M**, **512K**, **256K**, or **128K** (M stands for Mbps, while K stands for kbps). If you do not want to use this feature, keep the default, **Disable**.

Voice QoS

This setting allows you to limit the outgoing bandwidth for the application- or port-based QoS policies in use, so you can control how much bandwidth a particular application is allowed to use.

Enable/Disable. To limit outgoing bandwidth for the QoS policies in use, select **Enable**. Otherwise, select **Disable**.

QoS Upstream Rate. If you want the Router to automatically detect the QoS upstream rate, keep the default, **Auto Detect**. The rate will be automatically displayed. If you want to manually set the maximum QoS upstream rate, select **Manual**. Then enter the maximum speed in kbps; the default is **256** kbps.

When you have finished making changes to this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

The Administration Tab - Management

When you click the Administration tab, you will see the *Management* screen. This screen allows you to change the Router's access settings as well as configure the UPnP (Universal Plug and Play) features.

Figure 5-30: Administration Tab - Management

Router Password

Local Router Access

To ensure the Router's security, you will be asked for your password when you access the Router's Web-based Utility. The default password is **admin**.

Router Password. It is recommended that you change the default password to one of your choice.

Re-enter to confirm. Re-enter the Router's new Password to confirm it.

Remote Router Access

This feature allows you to access the Router from a remote location, via the Internet.

Remote Upgrade. Remote Upgrade allows you to upgrade the Router's firmware from a remote location. To enable this feature, click the **Enabled** radio button. Remote Administration must be activated before you can access the Router from a remote location.

Remote Administration. This feature allows you to manage the Router from a remote location, via the Internet. To enabled Remote Administration, click the **Enabled** radio button.

Administration Port. Enter the port number you will use to remotely access the Router.

NOTE: When you are in a remote location and wish to manage the Router, enter *http://<Internet IP Address>: port*. Enter the Router's specific Internet IP address in place of *<Internet IP Address>*, and enter the Administration Port number in place of the word *port*.

UPnP

UPnP. UPnP allows Windows XP to automatically configure the Router for various Internet applications, such as gaming and videoconferencing.

Allow users to make configuration changes. When enabled, this feature allows you to make manual changes while still using the UPnP feature.

Allow users to disable Internet access. When enabled, this feature allows you to prohibit any and all Internet connections.

Backup and Restore

Backup and Restore. If you want to back up or restore the Router's configuration file, click this button. The *Backup & Restore Configuration* screen will appear.

To back up the Router's configuration file, click the **Backup** button. Then follow the on-screen instructions.

To restore the Router's configuration file, click the **Browse** button to locate the file, and follow the on-screen instructions. After you have selected the file, click the **Restore** button.

When you have finished making changes to this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

Figure 5-31: Back up & Restore Configuration

The Administration Tab - Log

When you click the Administration tab, you will see the *Log* screen. It provides you with a log of all incoming and outgoing URLs or IP addresses for your Internet connection.

Figure 5-32: Administration Tab - Log

Log

Log. To access activity logs, select the **Yes** radio button. With logging enabled, you can choose to view temporary logs or keep a permanent record using the Logviewer software. Click the **No** button to disable this function.

Logviewer IP Address. For a permanent record of these logs, Logviewer software must be used. This software is downloadable from the Linksys website, *www.linksys.com*. The Logviewer saves all incoming and outgoing activity in a permanent file on your PC's hard drive. In the *Logviewer IP Address* field, enter the fixed IP address of the PC running the Logviewer software. The Router will now send updated logs to that PC.

Incoming Log. Click the **Incoming Log** button to view a temporary log of the Source IP addresses and Destination Port Numbers for all the incoming Internet traffic. Click the **Refresh** button to update the log.

Figure 5-33: Incoming Log Table

Outgoing Log. Click the **Outgoing Log** button to view a temporary log of all the URLs and IP addresses of Internet sites that users on your network have accessed. The LAN IP address, Destination URL/IP, and Service/Port Number for each site are listed. Click the **Refresh** button to update the log.

Figure 5-34: Outgoing Log Table

When you have finished making changes to this screen, click the **Save Settings** button to save the changes, or click the **Cancel Changes** button to undo your changes. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

The Administration Tab - Factory Defaults

The *Factory Defaults* screen is protected by a password available only from Vonage. Contact Vonage for more information.

Figure 5-35: Administration Tab - Factory Defaults

The Administration Tab - Firmware Upgrade

Upgrading the Router's firmware requires a password available only from Vonage. Contact Vonage for more information.

Figure 5-36: Administration Tab - Firmware Upgrade

***firmware**: the programming code that runs a networking device.*

***upgrade**: to replace existing software or firmware with a newer version.*

The Status Tab - Voice

Figure 5-37: Status Tab - Voice

The *Voice* screen displays information about your Internet phone line(s).

Information

Voice Version. This shows the version number of the voice firmware currently installed on the Router.

Line1 Status

Registration Status. The phone number and status of this Internet phone line are displayed here, so you know whether or not the phone line is registered with Vonage. If it is not registered, then you should register it with Vonage. If the status indicates that the registration has failed, then refer to "Appendix A: Troubleshooting."

Call1 Status. The status of the active phone call is shown here.

Call2 Status. If you are using call waiting, the status of the incoming phone call is shown here.

Line2 Status

Registration Status. The phone number and status of this Internet phone line are displayed here, so you know whether or not the phone line is registered with Vonage. If it is not registered, then you should register it with Vonage. If the status indicates that the registration has failed, then refer to "Appendix A: Troubleshooting."

Call1 Status. The status of the active phone call is shown here.

Call2 Status. If you are using call waiting, the status of the incoming phone call is shown here.

Click the **Refresh** button to update the on-screen information. For help information, click **More**.

The Status Tab - Router

The *Router* screen displays information about the Router and its current settings. The on-screen information will vary depending on the Internet Connection Type selected on the *Setup* screen.

Figure 5-38: Status Tab - Router

Information

Firmware Version. This shows the installed version and date of the firmware.

Current Time. The current time and date are displayed here.

MAC Address. The MAC Address of the Router's Internet interface is displayed here. (When you sign up for your Internet phone service account, you will need to provide the MAC address of the Router.)

Status

Login Type. This indicates the type of Internet connection you are using.

Login Status. The status is displayed only for dial-up style connections: PPPoE, RAS, PPTP, and Heart Beat Signal. There is a Connect button to click if there is no Internet connection and you want to re-connect.

Internet IP Address. The Router's Internet IP Address is displayed here.

Subnet Mask and Default Gateway. The Router's Subnet Mask and Default Gateway address are displayed here for DHCP and static IP connections.

DNS 1-3. Shown here are the DNS (Domain Name System) IP addresses currently used by the Router.

DHCP Release. Available for a DHCP connection, click the **DHCP Release** button to release the current IP address of the device connected to the Router's Internet port.

DHCP Renew. Available for a DHCP connection, click the **DHCP Renew** button to replace the current IP address—of the device connected to the Router's Internet port—with a new IP address.

Click the **Refresh** button to update the on-screen information. For help information, click **More**.

The Status Tab - Local Network

The *Local Network* screen displays information about the local network.

Figure 5-39: Status Tab - Local Network

Local Network

MAC Address. The MAC Address of the Router's LAN (local area network) interface is displayed here.

IP Address. The Router's local IP Address is shown here.

Subnet Mask. The Router's Subnet Mask is shown here.

DHCP Server. The status of the DHCP server is displayed here.

DHCP Client Table. Click the **DHCP Clients Table** button to view a list of PCs that have been assigned IP addresses by the Router. The *DHCP Active IP Table* screen lists the DHCP Server IP Address, Client Hostnames, IP Addresses, MAC Addresses, and Interfaces. Click the **Delete** checkbox to delete a DHCP client listing. Click the **Refresh** button to update the information.

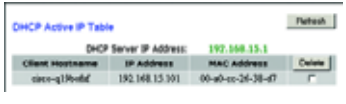

Figure 5-40: DHCP Active IP Table

Click the **Refresh** button to update the on-screen information. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

The Status Tab - Wireless

The *Wireless* screen displays status information about your wireless network.

Figure 5-41: Status Tab - Wireless

Wireless

MAC Address. The MAC Address of the Router's wireless network interface is displayed here.

Mode. As selected from the Wireless tab, this will display the wireless mode (Mixed, G-Only, or Disabled) used by the network.

SSID. As entered on the Wireless tab, this will display the wireless network name or SSID.

DHCP Server. The status of the DHCP server is displayed here.

Channel. As entered on the Wireless tab, this will display the channel on which your wireless network is broadcasting.

Encryption Function. As selected on the Wireless Security tab, this will display what type of encryption the Router uses for security.

Click the **Refresh** button to update the on-screen information. Help information is shown on the right-hand side of a screen. For additional information, click **More**.

Appendix A: Troubleshooting

This appendix provides solutions to problems that may occur during the installation and operation of the Router. Read the description below to solve your problems. If you can't find an answer here, check the Vonage website at *www.vonage.com* or the Linksys website at *www.linksys.com*.

Common Problems and Solutions

1. ***I don't hear a dial tone, and the PHONE1 (or PHONE2) LED is not lit.***
   Go through this checklist until your problem is solved:
   - Make sure the telephone is plugged into the appropriate port, Phone 1 or Phone 2.
   - Disconnect and re-connect the RJ-11 telephone cable between the Router and telephone.
   - Make sure your telephone is set to its tone setting (not pulse).
   - Make sure your network has an active Internet connection. Try to access the Internet, and check to see if the Router's Internet LED is lit. If you do not have a connection, power off your network devices, including the Router and cable/DSL modem. Wait 30 seconds, and power on the cable/DSL modem first. Then power on the Router and other network devices.
   - Verify your account information and confirm that the phone line is registered with Vonage.

2. ***I'm trying to access the Router's Web-based Utility, but I do not see the login screen. Instead, I see a screen saying, "404 Forbidden."***
   If you are using Windows Explorer, perform the following steps until you see the Web-based Utility's login screen (Netscape Navigator will require similar steps):
   A. Click **File**. Make sure *Work Offline* is NOT checked.
   B. Press **CTRL + F5**. This is a hard refresh, which will force Windows Explorer to load new webpages, not cached ones.

C. Click **Tools**. Click **Internet Options**. Click the **Security** tab. Click the **Default level** button. Make sure the security level is Medium or lower. Then click the **OK** button.

3. I need to set a static IP address on a PC.

The Router, by default, assigns an IP address range of 192.168.15.100 to 192.168.15.150 using the DHCP server on the Router. To set a static IP address, you can only use the ranges 192.168.15.2 to 192.168.15.99 and 192.168.15.151 to 192.168.15.254. Each PC or network device that uses TCP/IP must have a unique address to identify itself in a network. If the IP address is not unique to a network, Windows will generate an IP conflict error message. You can assign a static IP address to a PC by performing the following steps:

For Windows 98 and Millennium:

A. Click **Start**, **Setting**, and **Control Panel**. Double-click **Network**.
B. In *The following network components are installed* box, select the **TCP/IP**-> associated with your Ethernet adapter. If you only have one Ethernet adapter installed, you will only see one TCP/IP line with no association to an Ethernet adapter. Highlight it and click the **Properties** button.
C. In the *TCP/IP properties* window, select the **IP address** tab, and select **Specify an IP address**. Enter a unique IP address that is not used by any other computer on the network connected to the Router. You can only use an IP address in the ranges 192.168.15.2 to 192.168.15.99 and 192.168.15.151 to 192.168.15.254. Make sure that each IP address is unique for each PC or network device.
D. Click the **Gateway** tab, and in the *New Gateway* prompt, enter **192.168.15.1**, which is the default IP address of the Router. Click the **Add** button to accept the entry.
E. Click the **DNS** tab, and make sure the **DNS Enabled** option is selected. Enter the Host and Domain names (e.g., John for Host and home for Domain). Enter the DNS entry provided by your ISP. If your ISP has not provided the DNS IP address, contact your ISP to get that information or go to its website for the information.
F. Click the **OK** button in the *TCP/IP properties* window, and click **Close** or the **OK** button for the *Network* window.
G. Restart the computer when asked.

For Windows 2000:

A. Click **Start**, **Settings**, and **Control Panel**. Double-click **Network and Dial-Up Connections**.
B. Right-click the **Local Area Connection** that is associated with the Ethernet adapter you are using, and select the **Properties** option.
C. In the *Components checked are used by this connection* box, highlight **Internet Protocol (TCP/IP)**, and click the **Properties** button. Select **Use the following IP address** option.
D. Enter a unique IP address that is not used by any other computer on the network connected to the Router. You can only use an IP address in the ranges 192.168.15.2 to 192.168.15.99 and 192.168.15.151 to 192.168.15.254.
E. Enter the Subnet Mask, **255.255.255.0**.
F. Enter the Default Gateway, **192.168.15.1** (Router's default IP address).
G. Toward the bottom of the window, select **Use the following DNS server addresses**, and enter the Preferred DNS server and Alternative DNS server (provided by your ISP). Contact your ISP or go on its website to find the information.
H. Click the **OK** button in the *Internet Protocol (TCP/IP) Properties* window, and click the **OK** button in the *Local Area Connection Properties* window.
I. Restart the computer if asked.

For Windows XP:

The following instructions assume you are running Windows XP with the default interface. If you are using the Classic interface (where the icons and menus look like previous Windows versions), please follow the instructions for Windows 2000.

A. Click **Start** and **Control Panel**.
B. Click the **Network and Internet Connections** icon and then the **Network Connections** icon.
C. Right-click the **Local Area Connection** that is associated with the Ethernet adapter you are using, and select the **Properties** option.

D. In the *This connection uses the following items* box, highlight **Internet Protocol (TCP/IP)**. Click the **Properties** button.
E. Enter a unique IP address that is not used by any other computer on the network connected to the Router. You can only use an IP address in the ranges 192.168.15.2 to 192.168.15.99 and 192.168.15.151 to 192.168.15.254.
F. Enter the Subnet Mask, **255.255.255.0**.
G. Enter the Default Gateway, **192.168.15.1** (Router's default IP address).
H. Toward the bottom of the window, select **Use the following DNS server addresses**, and enter the Preferred DNS server and Alternative DNS server (provided by your ISP). Contact your ISP or go on its website to find the information.
I. Click the **OK** button in the *Internet Protocol (TCP/IP) Properties* window. Click the **OK** button in the *Local Area Connection Properties* window.

4. I want to test my Internet connection.

A. Check your TCP/IP settings.

For Windows 98 and Millennium:

Refer to Windows Help for details. Make sure **Obtain IP address automatically** is selected in the settings.

For Windows 2000:

1. Click **Start**, **Settings**, and **Control Panel**. Double-click **Network and Dial-Up Connections**.
2. Right-click the **Local Area Connection** that is associated with the Ethernet adapter you are using, and select the **Properties** option.
3. In the *Components checked are used by this connection* box, highlight **Internet Protocol (TCP/IP)**, and click the **Properties** button. Make sure that **Obtain an IP address automatically** and **Obtain DNS server address automatically** are selected.

4. Click the **OK** button in the *Internet Protocol (TCP/IP) Properties* window, and click the **OK** button in the *Local Area Connection Properties* window.
5. Restart the computer if asked.
6. Click the **OK** button in the *Internet Protocol (TCP/IP) Properties* window, and click the **OK** button in the *Local Area Connection Properties* window.
7. Restart the computer if asked.

For Windows XP:

The following instructions assume you are running Windows XP with the default interface. If you are using the Classic interface (where the icons and menus look like previous Windows versions), please follow the instructions for Windows 2000.

1. Click **Start** and **Control Panel**.
2. Click the **Network and Internet Connections** icon and then the **Network Connections** icon.
3. Right-click the **Local Area Connection** that is associated with the Ethernet adapter you are using, and select the **Properties** option.
4. In the *This connection uses the following items* box, highlight **Internet Protocol (TCP/IP)**, and click the **Properties** button. Make sure that **Obtain an IP address automatically** and **Obtain DNS server address automatically** are selected.

B. Open a command prompt.
   - For Windows 98 and Millennium, click **Start** and **Run**. In the *Open* field, type **command**. Press the **Enter** key or click the **OK** button.
   - For Windows 2000 and XP, click **Start** and **Run**. In the *Open* field, type **cmd**. Press the **Enter** key or click the **OK** button.

C. In the command prompt, type **ping 192.168.15.1** and press the **Enter** key.
   - If you get a reply, the computer is communicating with the Router.

- If you do NOT get a reply, check the cable, and make sure **Obtain an IP address automatically** is selected in the TCP/IP settings for your Ethernet adapter.

D. In the command prompt, type **ping** followed by your Internet IP address and press the **Enter** key. The Internet IP Address can be found in the web interface of the Router. For example, if your Internet IP address is 1.2.3.4, you would enter **ping 1.2.3.4** and press the **Enter** key.
   - If you get a reply, the computer is connected to the Router.
   - If you do NOT get a reply, try the ping command from a different computer to verify that your original computer is not the cause of the problem.

E. In the command prompt, type **ping www.linksys.com** and press the **Enter** key.
   - If you get a reply, the computer is connected to the Internet. If you cannot open a webpage, try the ping command from a different computer to verify that your original computer is not the cause of the problem.
   - If you do NOT get a reply, there may be a problem with the connection. Try the ping command from a different computer to verify that your original computer is not the cause of the problem.

5. I am not getting an IP address on the Internet with my Internet connection.

A. Refer to "Problem #4, I want to test my Internet connection" to verify that you have connectivity.
B. If you need to register the MAC address of your Ethernet adapter with your ISP, please see "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter." If you need to clone the MAC address of your Ethernet adapter onto the Router, see the MAC Address Clone section of "Chapter 5: Configuring the Router" for details.
C. Make sure you are using the right Internet settings. Contact your ISP to see if your Internet connection type is DHCP, Static IP Address, or PPPoE (commonly used by DSL consumers). Please refer to the Basic Setup section of "Chapter 5: Configuring the Router" for details on Internet Connection Type settings.
D. Make sure you use the right cable. Check to see if the Internet LED is solidly lit.

E. Make sure the cable connecting from your cable or DSL modem is connected to the Router's Internet port. Verify that the Status page of the Router's Web-based Utility shows a valid IP address from your ISP.
F. Turn off the computer, Router, and cable/DSL modem. Wait 30 seconds, and then turn on the Router, cable/DSL modem, and computer. Check the Status tab of the Router's Web-based Utility to see if you get an IP address.

6. I am not able to access the Router's Web-based Utility Setup page.

A. Refer to "Problem #4, I want to test my Internet connection" to verify that your computer is properly connected to the Router.
B. Refer to "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter" to verify that your computer has an IP Address, Subnet Mask, Gateway, and DNS.
C. Set a static IP address on your system; refer to "Problem #3: I need to set a static IP address on a PC."
D. Refer to "Problem #12: I am a PPPoE user, and I need to remove the proxy settings or the dial-up pop-up window."

7. I can't get my Virtual Private Network (VPN) to work through the Router.

Access the Router's web interface by going to **http://192.168.15.1** or the IP address of the Router, and go to the **Security** => **VPN Passthrough** tab. Make sure you have IPsec passthrough and/or PPTP passthrough enabled.

VPNs that use IPSec with the ESP (Encapsulation Security Payload known as protocol 50) authentication will work fine. At least one IPSec session will work through the Router; however, simultaneous IPSec sessions may be possible, depending on the specifics of your VPNs.

VPNs that use IPSec and AH (Authentication Header known as protocol 51) are incompatible with the Router. AH has limitations due to occasional incompatibility with the NAT standard.

Change the IP address for the Router to another subnet to avoid a conflict between the VPN IP address and your local IP address. For example, if your VPN server assigns an IP address 192.168.15.X (X is a number from 1 to 254) and your local LAN IP address is 192.168.15.X (X is the same number used in the VPN IP address), the Router will have difficulties routing information to the right location. If you change the Router's IP address to 192.168.2.1, that should solve the problem. Change the Router's IP address through the Basic Setup tab of the Web-based Utility. If you assigned a static IP address to any computer or network device on the network, you need to change its IP address accordingly to 192.168.2.Y (Y being any number from 1 to 254). Note that each IP address must be unique within the network.

Your VPN may require port 500/UDP packets to be passed to the computer that is connecting to the IPSec server. Refer to "Problem #9, I need to set up online game hosting or use other Internet applications" for details. Check the Linksys website at *www.linksys.com* for more information.

8. I need to set up a server behind my Router.

To use a server like a web, ftp, or mail server, you need to know the respective port numbers they are using. For example, port 80 (HTTP) is used for web; port 21 (FTP) is used for FTP, and port 25 (SMTP outgoing) and port 110 (POP3 incoming) are used for the mail server. You can get more information by viewing the documentation provided with the server you installed. Follow these steps to set up port forwarding through the Router's Web-based Utility. We will be setting up web, ftp, and mail servers.

A. Access the Router's Web-based Utility by going to **http://192.168.15.1** or the IP address of the Router. Go to the **Applications & Gaming** => **Port Range Forwarding** tab.
B. Enter any name you want to use for the Application.
C. Enter the port range of the service you are using. For example, if you have a web server, you would enter the range 80 to 80.
D. Select the protocol you will be using, **TCP** or **UDP**, or select **Both**.
E. Enter the IP address of the PC or network device that you want the port server to go to. For example, if the web server's Ethernet adapter IP address is 192.168.15.100, you would enter 100 in the field

provided. Check "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter" for details on getting an IP address.

F. Check the **Enabled** option for the port services you want to use. Consider the examples below:

Application	Start and End	Protocol	IP Address	Enabled
Web server	80 to 80	Both	192.168.15.100	X
FTP server	21 to 21	TCP	192.168.15.101	X
SMTP (outgoing)	25 to 25	Both	192.168.15.102	X
POP3 (incoming)	110 to 110	Both	192.168.15.102	X

When you have completed the configuration, click the **Save Settings** button.

9. I need to set up online game hosting or use other Internet applications.

If you want to play online games or use Internet applications, most will work without doing any port forwarding or DMZ hosting. There may be cases when you want to host an online game or Internet application. This would require you to set up the Router to deliver incoming packets or data to a specific computer. This also applies to the Internet applications you are using. The best way to get the information on what port services to use is to go to the website of the online game or application you want to use. Follow these steps to set up online game hosting or use a certain Internet application:

A. Access the Router's Web-based Utility by going to **http://192.168.15.1** or the IP address of the Router. Go to the **Applications & Gaming** => **Port Range Forwarding** tab.
B. Enter any name you want to use for the Application.

C. Enter the port range of the service you are using. For example, if you have a web server, you would enter the range 80 to 80.
D. Select the protocol you will be using, **TCP** or **UDP**, or select **Both**.
E. Enter the IP address of the PC or network device that you want the port server to go to. For example, if the web server's Ethernet adapter IP address is 192.168.15.100, you would enter 100 in the field provided. Check "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter" for details on getting an IP address.
F. Check the **Enabled** option for the port services you want to use. Consider the examples below:

Application	Start and End	Protocol	IP Address	Enabled
UT	7777 to 27900	Both	192.168.15.100	X
Halflife	27015 to 27015	Both	192.168.15.105	X
PC Anywhere	5631 to 5631	UDP	192.168.15.102	X
VPN IPSEC	500 to 500	UDP	192.168.15.100	X

When you have completed the configuration, click the **Save Settings** button.

10. I can't get the Internet game, server, or application to work.

If you are having difficulties getting any Internet game, server, or application to function properly, consider exposing one PC to the Internet using DeMilitarized Zone (DMZ) hosting. This option is available when an application requires too many ports or when you are not sure which port services to use. Make sure you disable all the forwarding entries if you want to successfully use DMZ hosting, since forwarding has priority over DMZ hosting. (In other words, data that enters the Router will be checked first by the forwarding settings. If the port number that the data enters from does not have port forwarding, then the Router will

send the data to whichever PC or network device you set for DMZ hosting.) Follow these steps to set DMZ hosting:

A. Access the Router's Web-based Utility by going to **http://192.168.15.1** or the IP address of the Router. Go to the **Applications & Gaming** => **Port Range Forwarding** tab.
B. Disable or remove the entries you have entered for forwarding. Keep this information in case you want to use it at a later time.
C. Click the **DMZ** tab.
D. Enter the Ethernet adapter's IP address of the computer you want exposed to the Internet. This will bypass the NAT security for that computer. Please refer to "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter" for details on getting an IP address.

Once completed with the configuration, click the **Save Settings** button.

11. I forgot my password, or the password prompt always appears when saving settings to the Router.
Reset the Router to factory default by pressing the Reset button for 30 seconds and then releasing it. If you are still getting prompted for a password when saving settings, then perform the following steps:

A. Access the Router's web interface by going to **http://192.168.15.1** or the IP address of the Router. Enter the default password admin, and click the **Administration** => **Management** tab.
B. Enter a different password in the *Router Password* field, and enter the same password in the second field to confirm the password.
C. Click the **Save Settings** button.

12. I am a PPPoE user, and I need to remove the proxy settings or the dial-up pop-up window.
If you have proxy settings, you need to disable these on your computer. Because the Router is the gateway for the Internet connection, the computer does not need any proxy settings to gain access. Please follow

these directions to verify that you do not have any proxy settings and that the browser you use is set to connect directly to the LAN.

For Microsoft Internet Explorer 5.0 or higher:

A. Click **Start**, **Settings**, and **Control Panel**. Double-click **Internet Options**.
B. Click the **Connections** tab.
C. Click the **LAN settings** button and remove anything that is checked.
D. Click the **OK** button to go back to the previous screen.
E. Click the option **Never dial a connection**. This will remove any dial-up pop-ups for PPPoE users.

For Netscape 4.7 or higher:

A. Start **Netscape Navigator**, and click **Edit**, **Preferences**, **Advanced**, and **Proxies**.
B. Make sure you have **Direct connection to the Internet** selected on this screen.
C. Close all the windows to finish.

13. To start over, I need to set the Router to factory default.

Hold the Reset button for approximately five seconds and then release it. This will return the password, forwarding, and other settings on the Router to the factory default settings. In other words, the Router will revert to its original factory configuration.

14. My DSL service's PPPoE is always disconnecting.

PPPoE is not actually a dedicated or always-on connection. The DSL ISP can disconnect the service after a period of inactivity, just like a normal phone dial-up connection to the Internet. There is a setup option to "keep alive" the connection. This may not always work, so you may need to re-establish connection periodically.

A. To connect to the Router, go to the web browser, and enter **http://192.168.15.1** or the IP address of the Router.
B. Enter the password, if asked. (The default password is admin.)
C. On the *Basic Setup* tab, select the option **Keep Alive**, and set the *Redial Period* option at **20** (seconds).
D. Click the **Save Settings** button.
E. Click the **Status** tab, and click the **Connect** button.
F. You may see the login status display as Connecting. Press the **F5** key to refresh the screen, until you see the login status display as Connected.

If the connection is lost again, follow steps E and F to re-establish connection.

15. I can't access my email, web, or VPN, or I am getting corrupted data from the Internet.

The Maximum Transmission Unit (MTU) setting may need to be adjusted. By default, the MTU is set at 1500. For most DSL users, it is strongly recommended to use MTU 1492. If you are having some difficulties, perform the following steps:

A. To connect to the Router, go to the web browser, and enter **http://192.168.15.1** or the IP address of the Router.
B. Enter the password, if asked. (The default password is **admin**.)
C. On the *Basic Setup* tab, look for the MTU option, and select **Enable**. In the *Size* field, enter 1492.
D. Click the **Save Settings** button to continue.

If your difficulties continue, change the Size to different values. Try this list of values, one value at a time, in this order, until your problem is solved:

1462
1400
1362
1300

16. I need to use port triggering.

Port triggering looks at the outgoing port services used and will trigger the Router to open a specific port, depending on which port an Internet application uses. Follow these steps:

A. To connect to the Router, go to the web browser, and enter **http://192.168.15.1** or the IP address of the Router.
B. Enter the password, if asked. (The default password is **admin**.)
C. Click the **Applications & Gaming** => **Port Triggering** tab.
D. Enter any name you want to use for the Application Name.
E. Enter the Start and End Ports of the Triggered Port Range. Check with your Internet application provider for more information on which outgoing port services it is using.
F. Enter the Start and End Ports of the Forwarded Port Range. Check with your Internet application provider for more information on which incoming port services are required by the Internet application.

17. When I enter a URL or IP address, I get a time-out error or am prompted to retry.

Go through this checklist until your problem is solved:

- Check if other PCs work. If they do, ensure that your workstation's IP settings are correct (IP Address, Subnet Mask, Default Gateway, and DNS). Restart the computer that is having a problem.
- If the PCs are configured correctly, but still not working, check the Router. Ensure that it is connected and powered on. Connect to it and check its settings. (If you cannot connect to it, check the LAN and power connections.)
- If the Router is configured correctly, check your Internet connection (DSL/cable modem, etc.) to see if it is working correctly. You can remove the Router to verify a direct connection.
- Manually configure the TCP/IP with a DNS address provided by your ISP.
- Make sure that your browser is set to connect directly and that any dial-up is disabled. For Internet Explorer, click **Tools**, **Internet Options**, and then the **Connection** tab. Make sure that Internet Explorer is set to **Never dial a connection**. For Netscape Navigator, click **Edit**, **Preferences**, **Advanced**, and **Proxy**. Make sure that Netscape Navigator is set to **Direct connection to the Internet**.

Frequently Asked Questions

How do I make a phone call?
Pick up the phone and dial. Use 7-, 10-, or 11-digit dialing for calls within the same area code as your Vonage phone number. Use 10- or 11-digit dialing for calls outside of your area code.

Can I make calls if my Internet connection is down?
No. Your high-speed Internet connection must be active when you make Internet phone or fax calls.

Can I make calls while I'm browsing the Internet?
Yes. You can make Internet phone or fax calls while browsing the Internet. However, your web browsing may affect the quality of your telephone call, depending on the amount of upstream data traffic passing through your Internet connection.

Can I receive calls while my network is down?
You cannot directly receive calls while your network is down. However, Vonage can forward calls to a different telephone number, such as a cellular phone number, if you activate a feature called Network Availability Number. You can configure this feature through your service account at www.vonage.com.

What is the maximum number of IP addresses that the Router will support?
The Router will support up to 253 IP addresses.

Is IPSec Passthrough supported by the Router?
Yes, enable or disable IPSec Passthrough on the Security => VPN Passthrough tab.

Where is the Router installed on the network?
In a typical environment, the Router is installed between the cable/DSL modem and the local area network (LAN). Plug the Router into the cable/DSL modem's Ethernet port.

Does the Router support IPX or AppleTalk?

No. TCP/IP is the only protocol standard for the Internet and has become the global standard for communications. IPX, a NetWare communications protocol used only to route messages from one node to another, and AppleTalk, a communications protocol used on Apple and Macintosh networks, can be used for LAN to LAN connections, but those protocols cannot connect from the Internet to the LAN.

What is Network Address Translation and what is it used for?

Network Address Translation (NAT) translates multiple IP addresses on the private LAN to one public address that is sent out to the Internet. This adds a level of security since the address of a PC connected to the private LAN is never transmitted on the Internet. Furthermore, NAT allows the Router to be used with low cost Internet accounts, such as DSL or cable modems, when only one TCP/IP address is provided by the ISP. The user may have many private addresses behind this single address provided by the ISP.

Does the Router support any operating system other than Windows 98, Millennium, 2000, or XP?

Yes, but Linksys does not, at this time, provide technical support for setup, configuration or troubleshooting of any non-Windows operating systems.

Does the Router support ICQ send file?

Yes, with the following fix: click **ICQ menu** => **preference** => **connections** tab=>, and check **I am behind a firewall or proxy**. Then set the firewall time-out to 80 seconds in the firewall setting. The Internet user can then send a file to a user behind the Router.

I set up an Unreal Tournament Server, but others on the LAN cannot join. What do I need to do?

If you have a dedicated Unreal Tournament server running, you need to create a static IP for each of the LAN computers and forward ports 7777, 7778, 7779, 7780, 7781, and 27900 to the IP address of the server. You can also use a port forwarding range of 7777 to 27900. If you want to use the UT Server Admin, forward another port (8080 usually works well but is used for remote admin. You may have to disable this.), and then in the

[UWeb.WebServer] section of the server.ini file, set the ListenPort to 8080 (to match the mapped port above) and ServerName to the IP assigned to the Router from your ISP.

Can multiple gamers on the LAN get on one game server and play simultaneously with just one public IP address?

It depends on which network game or what kind of game server you are using. For example, Unreal Tournament supports multi-login with one public IP.

How do I get* Half-Life: Team Fortress *to work with the Router?

The default client port for Half-Life is 27005. The computers on your LAN need to have "+clientport 2700x" added to the HL shortcut command line; the x would be 6, 7, 8, and on up. This lets multiple computers connect to the same server. One problem: Version 1.0.1.6 won't let multiple computers with the same CD key connect at the same time, even if on the same LAN (not a problem with 1.0.1.3). As far as hosting games, the HL server does not need to be in the DMZ. Just forward port 27015 to the local IP address of the server computer.

How can I block corrupted FTP downloads?

If you are experiencing corrupted files when you download a file with your FTP client, try using another FTP program.

The web page hangs; downloads are corrupt, or nothing but junk characters are being displayed on the screen. What do I need to do?

Force your Ethernet adapter to 10Mbps or half duplex mode, and turn off the "Auto-negotiate" feature of your Ethernet adapter as a temporary measure. (Please look at the Network Control Panel in your Ethernet adapter's Advanced Properties tab.) Make sure that your proxy setting is disabled in the browser. Check our website at *www.linksys.com* for more information.

If all else fails in the installation, what can I do?

Reset the Router by holding down the Reset button for approximately five seconds. Reset your cable or DSL modem by powering the unit off and then on. Contact Vonage for assistance. Refer to "Appendix H: Contact Information" for Vonage's contact information.

Will the Router function in a Macintosh environment?

Yes, but the Router's setup pages are accessible only through Internet Explorer 5.0 or Netscape Navigator 5.0 or higher for Macintosh.

I am not able to get the web configuration screen for the Router. What can I do?

You may have to remove the proxy settings on your Internet browser, e.g., Netscape Navigator or Internet Explorer. Or remove the dial-up settings on your browser. Check with your browser documentation, and make sure that your browser is set to connect directly and that any dial-up is disabled. Make sure that your browser is set to connect directly and that any dial-up is disabled. For Internet Explorer, click **Tools**, **Internet Options**, and then the **Connection** tab. Make sure that Internet Explorer is set to **Never dial a connection**. For Netscape Navigator, click **Edit**, **Preferences**, **Advanced**, and **Proxy**. Make sure that Netscape Navigator is set to **Direct connection to the Internet**.

What is DMZ Hosting?

Demilitarized Zone (DMZ) allows one IP address (computer) to be exposed to the Internet. Some applications require multiple TCP/IP ports to be open. It is recommended that you set your computer with a static IP if you want to use DMZ Hosting. To get the LAN IP address, see "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter."

If DMZ Hosting is used, does the exposed user share the public IP with the Router?

No.

Does the Router pass PPTP packets or actively route PPTP sessions?
The Router allows PPTP packets to pass through.

Is the Router cross-platform compatible?
Any platform that supports Ethernet and TCP/IP is compatible with the Router.

How many ports can be simultaneously forwarded?
Theoretically, the Router can establish 520 sessions at the same time, but you can only forward 10 ranges of ports.

Does the Router replace a modem? Is there a cable or DSL modem in the Router?
No, this version of the Router must work in conjunction with a cable or DSL modem.

Which modems are compatible with the Router?
The Router is compatible with virtually any cable or DSL modem that supports Ethernet.

What is the maximum number of VPN sessions allowed by the Router?
The maximum number depends on many factors. At least one IPSec session will work through the Router; however, simultaneous IPSec sessions may be possible, depending on the specifics of your VPNs.

How can I check whether I have static or DHCP IP addresses?
Ask your ISP to find out.

How do I get mIRC to work with the Router?
Under the Applications & Gaming => Port Range Forwarding tab, set port forwarding to **113** for the PC on which you are using mIRC.

Can I run an application from a remote computer over the wireless network?

This will depend on whether or not the application is designed to be used over a network. Consult the application's documentation to determine if it supports operation over a network.

What is the IEEE 802.11b standard?

It is one of the IEEE standards for wireless networks. The 802.11b standard allows wireless networking hardware from different manufacturers to communicate, provided that the hardware complies with the 802.11b standard. The 802.11b standard states a maximum data transfer rate of 11Mbps and an operating frequency of 2.4GHz.

What is the IEEE 802.11g standard?

It is one of the IEEE standards for wireless networks. The 802.11g standard allows wireless networking hardware from different manufacturers to communicate, provided that the hardware complies with the 802.11g standard. The 802.11g standard states a maximum data transfer rate of 54Mbps and an operating frequency of 2.4GHz.

What IEEE 802.11b features are supported?

The product supports the following IEEE 802.11b functions:

- CSMA/CA plus Acknowledge protocol
- Multi-Channel Roaming
- Automatic Rate Selection
- RTS/CTS feature
- Fragmentation
- Power Management

What IEEE 802.11g features are supported?

The product supports the following IEEE 802.11g functions:

- CSMA/CA plus Acknowledge protocol
- OFDM protocol
- Multi-Channel Roaming
- Automatic Rate Selection
- RTS/CTS feature
- Fragmentation
- Power Management

What is ad-hoc mode?

When a wireless network is set to ad-hoc mode, the wireless-equipped computers are configured to communicate directly with each other. The ad-hoc wireless network will not communicate with any wired network.

What is infrastructure mode?

When a wireless network is set to infrastructure mode, the wireless network is configured to communicate with a wired network through a wireless access point.

What is roaming?

Roaming is the ability of a portable computer to communicate continuously while moving freely throughout an area greater than that covered by a single access point. Before using the roaming function, the user must make sure that the computer uses the same channel number that is used by the access point of the dedicated coverage area.

To achieve true seamless connectivity, the wireless LAN must incorporate a number of different functions. Each node and access point, for example, must always acknowledge receipt of each message. Each node must maintain contact with the wireless network even when not actually transmitting data. Achieving these functions

simultaneously requires a dynamic RF networking technology that links access points and nodes. In such a system, the user's end node undertakes a search for the best possible access to the system. First, it evaluates such factors as signal strength and quality, as well as the message load currently being carried by each access point and the distance of each access point to the wired backbone. Based on that information, the node next selects the right access point and registers its address. Communications between end node and host computer can then be transmitted up and down the backbone.

As the user moves on, the end node's RF transmitter regularly checks the system to determine whether it is in touch with the original access point or whether it should seek a new one. When a node no longer receives acknowledgment from its original access point, it undertakes a new search. Upon finding a new access point, it then re-registers, and the communication process continues.

What is ISM band?

The FCC and their counterparts outside of the U.S. have set aside bandwidth for unlicensed use in the ISM (Industrial, Scientific and Medical) band. Spectrum in the vicinity of 2.4 GHz, in particular, is being made available worldwide. This presents a truly revolutionary opportunity to place convenient high-speed wireless capabilities in the hands of users around the globe.

What is Spread Spectrum?

Spread Spectrum technology is a wideband radio frequency technique developed by the military for use in reliable, secure, mission-critical communications systems. It is designed to trade off bandwidth efficiency for reliability, integrity, and security. In other words, more bandwidth is consumed than in the case of narrowband transmission, but the trade-off produces a signal that is, in effect, louder and thus easier to detect, provided that the receiver knows the parameters of the spread-spectrum signal being broadcast. If a receiver is not tuned to the right frequency, a spread-spectrum signal looks like background noise. There are two main alternatives, Direct Sequence Spread Spectrum (DSSS) and Frequency Hopping Spread Spectrum (FHSS).

What is DSSS? What is FHSS? And what are their differences?

Frequency-Hopping Spread-Spectrum (FHSS) uses a narrowband carrier that changes frequency in a pattern that is known to both transmitter and receiver. Properly synchronized, the net effect is to maintain a single logical channel. To an unintended receiver, FHSS appears to be short-duration impulse noise. Direct-Sequence Spread-Spectrum (DSSS) generates a redundant bit pattern for each bit to be transmitted. This bit pattern is called a chip (or chipping code). The longer the chip, the greater the probability that the original data can be recovered. Even if one or more bits in the chip are damaged during transmission, statistical techniques embedded in the radio can recover the original data without the need for retransmission. To an unintended receiver, DSSS appears as low power wideband noise and is rejected (ignored) by most narrowband receivers.

What is WEP?

WEP is Wired Equivalent Privacy, a data privacy mechanism based on a shared key algorithm, as described in the IEEE 802.11 standard.

What is WPA?

WPA is Wi-Fi Protected Access, a wireless security protocol that can be used in conjunction with a RADIUS server.

What is a MAC Address?

The Media Access Control (MAC) address is a unique number assigned by the manufacturer to any Ethernet networking device, such as a network adapter, that allows the network to identify it at the hardware level. For all practical purposes, this number is usually permanent. Unlike IP addresses, which can change every time a computer logs onto the network, the MAC address of a device stays the same, making it a valuable identifier for the network.

How do I reset the Router?

Press the Reset button on the back panel for about five seconds. This will reset the Router to its default settings.

How do I resolve issues with signal loss?

There is no way to know the exact range of your wireless network without testing. Every obstacle placed between the Router and a wireless PC will create signal loss. Lead glass, metal, concrete floors, water and walls will inhibit the signal and reduce range. Start with the Router and your wireless PC in the same room and move it away in small increments to determine the maximum range in your environment.

You may also try using different channels, as this may eliminate interference affecting only one channel.

I have excellent signal strength, but I cannot see my network.

Wireless security is probably enabled on the Router, but not on your wireless adapter (or vice versa). Verify that the same wireless security settings are being used by all devices in your wireless network.

How many channels/frequencies are available with the Router?

There are eleven available channels, ranging from 1 to 11 (in North America).

Appendix B: Wireless Security

Linksys wants to make wireless networking as safe and easy for you as possible. The current generation of Linksys products provide several network security features, but they require specific action on your part for implementation. So, keep the following in mind whenever you are setting up or using your wireless network.

Security Precautions

The following is a complete list of security precautions to take (at least steps 1 through 5 should be followed):

1. Change the default SSID.
2. Disable SSID Broadcast.
3. Change the default password for the Administrator account.
4. Enable MAC Address Filtering.
5. Change the SSID periodically.
6. Use the highest encryption algorithm possible. Use WPA if it is available. Please note that this may reduce your network performance.
7. Change the WEP encryption keys periodically.

For information on implementing these security features, refer to "Chapter 6: Configuring the Router."

NOTE: Some of these security features are available only through the network router or access point. Refer to the router or access point's documentation for more information.

Security Threats Facing Wireless Networks

Wireless networks are easy to find. Hackers know that in order to join a wireless network, wireless networking products first listen for "beacon messages". These messages can be easily decrypted and contain much of the network's information, such as the network's SSID (Service Set Identifier). Here are the steps you can take:

Change the administrator's password regularly. With every wireless networking device you use, keep in mind that network settings (SSID, WEP keys, etc.) are stored in its firmware. Your network administrator is the only person who can change network settings. If a hacker gets a hold of the administrator's password, he, too, can change those settings. So, make it harder for a hacker to get that information. Change the administrator's password regularly.

SSID. There are several things to keep in mind about the SSID:

1. Disable Broadcast
2. Make it unique
3. Change it often

Most wireless networking devices will give you the option of broadcasting the SSID. While this option may be more convenient, it allows anyone to log into your wireless network. This includes hackers. So, don't broadcast the SSID.

Wireless networking products come with a default SSID set by the factory. (The Linksys default SSID is "linksys".) Hackers know these defaults and can check these against your network. Change your SSID to something unique and not something related to your company or the networking products you use.

Change your SSID regularly so that any hackers who have gained access to your wireless network will have to start from the beginning in trying to break in.

MAC Addresses. Enable MAC Address filtering. MAC Address filtering will allow you to provide access to only those wireless nodes with certain MAC Addresses. This makes it harder for a hacker to access your network with a random MAC Address.

WEP Encryption. Wired Equivalent Privacy (WEP) is often looked upon as a cure-all for wireless security concerns. This is overstating WEP's ability. Again, this can only provide enough security to make a hacker's job more difficult.

There are several ways that WEP can be maximized:

1. Use the highest level of encryption possible
2. Use "Shared Key" authentication
3. Change your WEP key regularly

IMPORTANT: Always remember that each device in your wireless network MUST use the same encryption method and encryption key or your wireless network will not function properly.

WPA. Wi-Fi Protected Access (WPA) is the newest and best available standard in Wi-Fi security. Two modes are available: Pre-Shared Key and RADIUS. Pre-Shared Key gives you one encryption methods: TKIP (Temporal Key Integrity Protocol), which utilizes a stronger encryption method and incorporates Message Integrity Code (MIC) to provide protection against hackers.

WPA Pre-Shared Key. If you do not have a RADIUS server, Select the type of algorithm, TKIP or AES, enter a password in the Pre-Shared key field of 8-64 characters, and enter a Group Key Renewal period time between 0 and 99,999 seconds, which instructs the Router or other device how often it should change the encryption keys.

WPA RADIUS. WPA used in coordination with a RADIUS server. (This should only be used when a RADIUS server is connected to the Router or other device.) First, select the type of WPA algorithm, **TKIP** or **AES**. Enter the RADIUS server's IP Address and port number, along with a key shared between the device and the server. Last, enter a Group Key Renewal period, which instructs the device how often it should change the encryption keys.

Implementing encryption may have a negative impact on your network's performance, but if you are transmitting sensitive data over your network, encryption should be used.

These security recommendations should help keep your mind at ease while you are enjoying the most flexible and convenient technology Linksys has to offer.

Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter

This section describes how to find the MAC address for your computer's Ethernet adapter so you can use the MAC filtering and/or MAC address cloning feature of the Router. You can also find the IP address of your computer's Ethernet adapter. This IP address is used for the Router's filtering, forwarding, and/or DMZ features. Follow the steps in this appendix to find the adapter's MAC or IP address in Windows 98, Me, 2000, or XP.

Windows 98 or Me Instructions

1. Click **Start** and **Run**. In the *Open* field, enter **winipcfg**. Then press the **Enter** key or the **OK** button.
2. When the *IP Configuration* screen appears, select the Ethernet adapter you have connected to the Router via a CAT 5 Ethernet network cable.
3. Write down the Adapter Address as shown on your computer screen. This is the MAC address for your Ethernet adapter and is shown as a series of numbers and letters.

   The MAC address/Adapter Address is what you will use for MAC address cloning or MAC filtering.

   The example shows the Ethernet adapter's IP address as 192.168.1.100. Your computer may show something different.

Figure C-1: IP Configuration Screen

Figure C-2: MAC/Adapter Address

Windows 2000 or XP Instructions

1. Click **Start** and **Run**. In the *Open* field, enter **cmd**. Press the **Enter** key or click the **OK** button.
2. At the command prompt, enter **ipconfig /all**. Then press the **Enter** key.
3. Write down the Physical Address as shown on your computer screen; it is the MAC address for your Ethernet adapter. This appears as a series of numbers and letters.

   The MAC address/Physical Address is what you will use for MAC address cloning or MAC filtering.

   The example shows the Ethernet adapter's IP address as 192.168.1.100. Your computer may show something different.

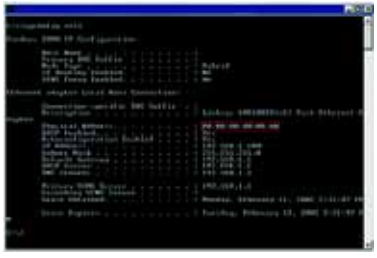

Figure C-3: MAC/Physical Address

For the Router's Web-based Utility

For MAC address cloning, enter the 12-digit MAC address in the fields provided, two digits per field.

For MAC filtering, enter the 12-digit MAC address in this format, XXXXXXXXXXXX, WITHOUT the hyphens.

Figure C-4: MAC Address Clone

Figure C-5: MAC Address Filter

Appendix D: Windows Help

Almost all Linksys products require Microsoft Windows. Windows is the most used operating system in the world and comes with many features that help make networking easier. These features can be accessed through Windows Help and are described in this appendix.

TCP/IP

Before a computer can communicate with a network router, TCP/IP must be enabled. TCP/IP is a set of instructions, or protocol, all PCs follow to communicate over a network. This is true for wireless networks as well. Your PCs will not be able to utilize wireless networking without having TCP/IP enabled. Windows Help provides complete instructions on enabling TCP/IP.

Shared Resources

If you wish to share printers, folder, or files over your network, Windows Help provides complete instructions on utilizing shared resources.

Network Neighborhood/My Network Places

Other PCs on your network will appear under Network Neighborhood or My Network Places (depending upon the version of Windows you're running). Windows Help provides complete instructions on adding PCs to your network.

Appendix E: Glossary

802.11b - A wireless networking standard that specifies a maximum data transfer rate of 11Mbps and an operating frequency of 2.4GHz.

802.11g - A wireless networking standard that specifies a maximum data transfer rate of 54Mbps, an operating frequency of 2.4GHz, and backward compatibility with 802.11b devices.

Access Point - A device that allows wireless-equipped computers and other devices to communicate with a wired network. Also used to expand the range of a wireless network.

Adapter - A device that adds network functionality to your PC.

Ad-hoc - A group of wireless devices communicating directly with each other (peer-to-peer) without the use of an access point.

AES (**A**dvanced **E**ncryption **S**tandard) - A security method that uses symmetric 128-bit block data encryption.

Backbone - The part of a network that connects most of the systems and networks together, and handles the most data.

Bandwidth - The transmission capacity of a given device or network.

Beacon Interval - Data transmitted on your wireless network that keeps the network synchronized.

Bit - A binary digit.

Boot - To start a device and cause it to start executing instructions.

Bridge - A device that connects different networks.

Broadband - An always-on, fast Internet connection.

Browser - An application program that provides a way to look at and interact with all the information on the World Wide Web.

Buffer - A shared or assigned memory area that is used to support and coordinate different computing and networking activities so one isn't held up by the other.

Byte - A unit of data that is usually eight bits long

Cable Modem - A device that connects a computer to the cable television network, which in turn connects to the Internet.

CSMA/CA (**C**arrier **S**ense **M**ultiple **A**ccess/**C**ollision **A**voidance) - A method of data transfer that is used to prevent data collisions.

CTS (**C**lear **T**o **S**end) - A signal sent by a wireless device, signifying that it is ready to receive data.

Daisy Chain - A method used to connect devices in a series, one after the other.

Database - A collection of data that is organized so that its contents can easily be accessed, managed, and updated.

DDNS (**D**ynamic **D**omain **N**ame **S**ystem) - Allows the hosting of a website, FTP server, or e-mail server with a fixed domain name (e.g., www.xyz.com) and a dynamic IP address.

Default Gateway - A device that forwards Internet traffic from your local area network.

DHCP (**D**ynamic **H**ost **C**onfiguration **P**rotocol) - A networking protocol that allows administrators to assign temporary IP addresses to network computers by “leasing” an IP address to a user for a limited amount of time, instead of assigning permanent IP addresses.

DMZ (**De**-**mi**litarized **Z**one) - Removes the Router's firewall protection from one PC, allowing it to be “seen” from the Internet.

DNS (**D**omain **N**ame **S**erver) - The IP address of your ISP's server, which translates the names of websites into IP addresses.

Domain - A specific name for a network of computers.

Download - To receive a file transmitted over a network.

DSL (**D**igital **S**ubscriber **L**ine) - An always-on broadband connection over traditional phone lines.

DSSS (**D**irect-**S**equence **S**pread-**S**pectrum) - Frequency transmission with a redundant bit pattern resulting in a lower probability of information being lost in transit.

DTIM (**D**elivery **T**raffic **I**ndication **M**essage) - A message included in data packets that can increase wireless efficiency.

Dynamic IP Address - A temporary IP address assigned by a DHCP server.

EAP (**E**xtensible **A**uthentication **P**rotocol) - A general authentication protocol used to control network access. Many specific authentication methods work within this framework.

EAP-PEAP (**E**xtensible **A**uthentication **P**rotocol-**P**rotected **E**xtensible **A**uthentication **P**rotocol) - A mutual authentication method that uses a combination of digital certificates and another system, such as passwords.

EAP-TLS (**E**xtensible **A**uthentication **P**rotocol-**T**ransport **L**ayer **S**ecurity) - A mutual authentication method that uses digital certificates.

Encryption - Encoding data transmitted in a network.

Ethernet - A networking protocol that specifies how data is placed on and retrieved from a common transmission medium.

Finger - A program that tells you the name associated with an e-mail address.

Firewall - A set of related programs located at a network gateway server that protects the resources of a network from users from other networks.

Firmware - The programming code that runs a networking device.

Fragmentation -Breaking a packet into smaller units when transmitting over a network medium that cannot support the original size of the packet.

FTP (**F**ile **T**ransfer **P**rotocol) - A protocol used to transfer files over a TCP/IP network.

Full Duplex - The ability of a networking device to receive and transmit data simultaneously.

Gateway - A device that interconnects networks with different, incompatible communications protocols.

Half Duplex - Data transmission that can occur in two directions over a single line, but only one direction at a time.

Hardware - The physical aspect of computers, telecommunications, and other information technology devices.

HTTP (**H**yper**T**ext **T**ransport **P**rotocol) - The communications protocol used to connect to servers on the World Wide Web.

Infrastructure - A wireless network that is bridged to a wired network via an access point.

IP (**I**nternet **P**rotocol) - A protocol used to send data over a network.

IP Address - The address used to identify a computer or device on a network.

IPCONFIG - A Windows 2000 and XP utility that displays the IP address for a particular networking device.

IPSec (**I**nternet **P**rotocol **Sec**urity) - A VPN protocol used to implement secure exchange of packets at the IP layer.

ISM band - Radio bandwidth utilized in wireless transmissions.

ISP (**I**nternet **S**ervice **P**rovider) - A company that provides access to the Internet.

LAN - The computers and networking products that make up your local network.

LEAP (**L**ightweight **E**xtensible **A**uthentication **P**rotocol) - A mutual authentication method that uses a username and password system.

MAC (**M**edia **A**ccess **C**ontrol) **Address** - The unique address that a manufacturer assigns to each networking device.

Mbps (**M**ega**B**its **P**er **S**econd) - One million bits per second; a unit of measurement for data transmission.

mIRC - An Internet Relay Chat program that runs under Windows.

Multicasting - Sending data to a group of destinations at once.

NAT (**N**etwork **A**ddress **T**ranslation) - NAT technology translates IP addresses of a local area network to a different IP address for the Internet.

NAT (**N**etwork **A**ddress **T**ranslation) **Traversal** -A method of enabling specialized applications, such as Internet phone calls, video, and audio, to travel between your local network and the Internet. STUN is a specific type of NAT traversal.

Network - A series of computers or devices connected for the purpose of data sharing, storage, and/or transmission between users.

NNTP (**N**etwork **N**ews **T**ransfer **P**rotocol) - The protocol used to connect to Usenet groups on the Internet.

Node - A network junction or connection point, typically a computer or work station.

OFDM (**O**rthogonal **F**requency **D**ivision **M**ultiplexing) - Frequency transmission that separates the data stream into a number of lower-speed data streams, which are then transmitted in parallel to prevent information from being lost in transit.

Packet - A unit of data sent over a network.

Passphrase - Used much like a password, a passphrase simplifies the WEP encryption process by automatically generating the WEP encryption keys for Linksys products.

Ping (**P**acket **IN**ternet **G**roper) - An Internet utility used to determine whether a particular IP address is online.

POP3 (**P**ost **O**ffice **P**rotocol **3**) - A standard mail server commonly used on the Internet.

Port - The connection point on a computer or networking device used for plugging in cables or adapters.

Power **o**ver **E**thernet (**PoE**) - A technology enabling an Ethernet network cable to deliver both data and power.

PPPoE (**P**oint to **P**oint **P**rotocol **o**ver **E**thernet) - A type of broadband connection that provides authentication (username and password) in addition to data transport.

PPTP (**P**oint-to-**P**oint **T**unneling **P**rotocol) - A VPN protocol that allows the Point to Point Protocol (PPP) to be tunneled through an IP network. This protocol is also used as a type of broadband connection in Europe.

Preamble - Part of the wireless signal that synchronizes network traffic.

RADIUS (**R**emote **A**uthentication **D**ial-**I**n **U**ser **S**ervice) - A protocol that uses an authentication server to control network access.

RJ-45 (**R**egistered **J**ack-**45**) - An Ethernet connector that holds up to eight wires.

Roaming - The ability to take a wireless device from one access point's range to another without losing the connection.

Router - A networking device that connects multiple networks together.

RTP (**R**eal-time **T**ransport **P**rotocol) - A protocol that enables specialized applications, such as Internet phone calls, video, and audio, to occur in real time.

RTS (**R**equest **T**o **S**end) - A networking method of coordinating large packets through the RTS Threshold setting.

Server - Any computer whose function in a network is to provide user access to files, printing, communications, and other services.

SMTP (**S**imple **M**ail **T**ransfer **P**rotocol) - The standard e-mail protocol on the Internet.

SNMP (**S**imple **N**etwork **M**anagement **P**rotocol) - A widely used network monitoring and control protocol.

Software - Instructions for the computer. A series of instructions that performs a particular task is called a “program”.

SOHO (**S**mall **O**ffice/**H**ome **O**ffice) - Market segment of professionals who work at home or in small offices.

SPI (**S**tateful **P**acket **I**nspection) **Firewall** - A technology that inspects incoming packets of information before allowing them to enter the network.

Spread Spectrum - Wideband radio frequency technique used for more reliable and secure data transmission.

SSID (**S**ervice **S**et **ID**entifier) - Your wireless network's name.

Static IP Address - A fixed address assigned to a computer or device that is connected to a network.

Static Routing - Forwarding data in a network via a fixed path.

STUN (**S**imple **T**raversal of **U**DP through **N**ATs) - A protocol that enables specialized applications, such as Internet phone calls, video, and audio, to travel between your local network and the Internet. STUN is a specific type of NAT traversal.

Subnet Mask - An address code that determines the size of the network.

Switch - 1. A data switch that connects computing devices to host computers, allowing a large number of devices to share a limited number of ports. 2. A device for making, breaking, or changing the connections in an electrical circuit.

TCP (**T**ransmission **C**ontrol **P**rotocol) - A network protocol for transmitting data that requires acknowledgement from the recipient of data sent.

TCP/IP (**T**ransmission **C**ontrol **P**rotocol/**I**nternet **P**rotocol) - A set of instructions PCs use to communicate over a network.

Telnet - A user command and TCP/IP protocol used for accessing remote PCs.

TFTP (**T**rivial **F**ile **T**ransfer **P**rotocol) - A version of the TCP/IP FTP protocol that has no directory or password capability.

Throughput - The amount of data moved successfully from one node to another in a given time period.

TKIP (**T**emporal **K**ey **I**ntegrity **P**rotocol) - a wireless encryption protocol that provides dynamic encryption keys for each packet transmitted.

Topology - The physical layout of a network.

TX Rate - Transmission Rate.

UDP (**U**ser **D**atagram **P**rotocol) - A network protocol for transmitting data that does not require acknowledgement from the recipient of the data that is sent.

Upgrade - To replace existing software or firmware with a newer version.

Upload - To transmit a file over a network.

URL (**U**niform **R**esource **L**ocator) - The address of a file located on the Internet.

VPN (**V**irtual **P**rivate **N**etwork) - A security measure to protect data as it leaves one network and goes to another over the Internet.

WAN (**W**ide **A**rea **N**etwork)- The Internet.

WEP (**W**ired **E**quivalent **P**rivacy) - A method of encrypting network data transmitted on a wireless network for greater security.

WINIPCFG - A Windows 98 and Me utility that displays the IP address for a particular networking device.

WLAN (**W**ireless **L**ocal **A**rea **N**etwork) - A group of computers and associated devices that communicate with each other wirelessly.

WPA (**W**i-Fi **P**rotected **A**ccess) - a wireless security protocol using TKIP (Temporal Key Integrity Protocol) encryption, which can be used in conjunction with a RADIUS server.

Appendix F: Specifications

Model	WRT54GP2
Standards	IEEE 802.3, IEEE 802.3u, 802.11b, 802.11g
Channels	11 Channels (US, Canada)
Transmit Power	18 dBm
Ports	One 10/100 RJ-45 Internet Port, Three 10/100 RJ-45 Network Ports, Two Standard Phone Ports, One Power Port
Button	One Reset Button
Cabling Type	RJ-45 Ethernet Category 5, RJ-11 Standard Phone Cable
LEDs	Power, WLAN (Wireless-G), Ethernet (1-3), Phone (1-2), Internet
Network Protocols	TCP/IP
Voice Protocol	Session Initiation Protocol Version 2 (RFC 3261, 3262, 3263, 3264)
Voice Codecs	G.711 a-law, G.711µ-Law, G.726, G.729 A, G.723.1
Ringer Equivalence Number (REN)	5 REN per RJ-11 port
Ring Frequency	10 Hz - 40 Hz
FXS Port Impedance	Eight Configurable Setting Including North America 600 ohms, European CTR21
Ring Voltage	60 - 90 Vrms Configurable
Security Features	NAT Firewall
Wireless Security Features	WPA, WEP, TKIP, RADIUS, Wireless MAC Filtering
UPnP able/cert	Certified

Dimensions (W x H x D)	7.32" x 1.89" x 7.87" (186 mm x 48 mm x 200 mm)
Unit Weight	13.30 oz. (0.38 kg)
Power	External, 12V DC, 1.0A
Certifications	FCC, CE, cUL, ICES-003, RSS210
Operating Temp.	0º to 40ºC (32º to 104ºF)
Storage Temp.	-20º to 70ºC (-4º to 158ºF)
Operating Humidity	10 to 85%, Non-Condensing
Storage Humidity	5 to 90%, Non-Condensing
Warranty	1-Year Limited

Appendix G: Warranty Information

LIMITED WARRANTY

Vonage warrants to You that, for a period of one year (the "Warranty Period"), your Linksys Product will be substantially free of defects in materials and workmanship under normal use. Your exclusive remedy and Vonage's entire liability under this warranty will be for Vonage at its option to repair or replace the Product or refund Your purchase price less any rebates. This limited warranty extends only to the original purchaser.

If the Product proves defective during the Warranty Period call Vonage Technical Support in order to obtain a Return Authorization Number, if applicable. If You are requested to return the Product, mark the Return Authorization Number clearly on the outside of the package. You are responsible for shipping defective Products to Vonage.

ALL IMPLIED WARRANTIES AND CONDITIONS OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED TO THE DURATION OF THE WARRANTY PERIOD. ALL OTHER EXPRESS OR IMPLIED CONDITIONS, REPRESENTATIONS AND WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF NON-INFRINGEMENT, ARE DISCLAIMED. Some jurisdictions do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to You. This warranty gives You specific legal rights, and You may also have other rights which vary by jurisdiction.

This warranty does not apply if the Product (a) has been altered, except by Vonage, (b) has not been installed, operated, repaired, or maintained in accordance with instructions supplied by Vonage, or (c) has been subjected to abnormal physical or electrical stress, misuse, negligence, or accident. In addition, due to the continual development of new techniques for intruding upon and attacking networks, Vonage does not warrant that the Product will be free of vulnerability to intrusion or attack.

TO THE EXTENT NOT PROHIBITED BY LAW, IN NO EVENT WILL VONAGE BE LIABLE FOR ANY LOST DATA, REVENUE OR PROFIT, OR FOR SPECIAL, INDIRECT, CONSEQUENTIAL, INCIDENTAL OR PUNITIVE DAMAGES, REGARDLESS OF THE THEORY OF LIABILITY (INCLUDING NEGLIGENCE), ARISING OUT OF OR RELATED TO THE USE OF OR INABILITY TO USE THE PRODUCT (INCLUDING ANY SOFTWARE), EVEN IF VONAGE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT WILL VONAGE' LIABILITY EXCEED THE AMOUNT PAID BY YOU FOR THE PRODUCT. The foregoing limitations will apply even if any warranty or

remedy provided under this Agreement fails of its essential purpose. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to You.

Please contact Vonage regarding the warranty for the Product. Refer to “Appendix I: Contact Information” for Vonage contact information.

Appendix H: Regulatory Information

FCC Statement

This product has been tested and complies with the specifications for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used according to the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which is found by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment or devices
- Connect the equipment to an outlet other than the receiver's
- Consult a dealer or an experienced radio/TV technician for assistance

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

Industry Canada (Canada)

This Class B digital apparatus complies with Canadian ICES-003, RSS210.
Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.
The use of this device in a system operating either partially or completely outdoors may require the user to obtain a license for the system according to the Canadian regulations.

SAFETY NOTICES

Caution: To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cord.

Do not use this product near water, for example, in a wet basement or near a swimming pool.

Avoid using this product during an electrical storm. There may be a remote risk of electric shock from lightning.

Appendix I: Contact Information

Vonage

Need to contact Vonage?	
If you wish to speak with Vonage Customer Care, you can call Vonage at:	24-hour: 1-VONAGE-HELP (866-243-4357) (toll-free from US)
If you are located in Canada, then call Vonage at:	24-hour: 877-272-0528 (toll-free from Canada)
If you are located outside of the US, then call Vonage at:	732-650-6699
Or fax your request in to:	732-333-1353
Visit Vonage online to access your account at:	http://www.vonage.com

Linksys

Need to contact Linksys?	
Visit Linksys online for information on the latest products and updates to your existing products at:	http://www.linksys.com or ftp.linksys.com
Can't find information about a product you want to buy on the web?	
Do you want to know more about networking with Linksys products?	
Give the Linksys advice line a call at:	800-546-5797 (LINKSYS)
Or fax your request in to:	949-823-3002

www.linksys.com